

W. Wright Smith

TRANSACTIONS AND PROCEEDINGS
OF THE
BOTANICAL SOCIETY OF EDINBURGH

VOLUME XXXVI.

PART III.

SESSION 1952-53.



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PROCEEDINGS
OF THE
BOTANICAL SOCIETY OF EDINBURGH

SESSION CXVII

OCTOBER 16, 1952.

Dr. J. M. COWAN, President, in the Chair.

The following Office-Bearers were elected for Session 1952-53:—

PRESIDENT.

J. M. COWAN, C.B.E., M.A., D.Sc.

VICE-PRESIDENTS.

R. A. TAYLOR, Ph.D., D.Sc.
Miss M. NOBLE, Ph.D.

J. T. JOHNSTONE, M.A., B.Sc.
J. A. MACDONALD, Ph.D., D.Sc.

COUNCILLORS.

Mrs. E. M. KNOX, D.Sc.
Professor J. R. MATTHEWS, M.A.
Professor K. W. BRAID, M.A., B.Sc.
J. B. SIMPSON, D.Sc.
P. DAVIS, B.Sc.

B. L. BURTT, B.Sc., F.L.S.
G. J. FLEMING.
J. G. ROGER, B.Sc.
W. HANDYSIDE.
J. W. GREGOR, Ph.D., F.L.S.

Honorary Secretary—J. ROBERTS, B.Sc.

Assistant Secretary—Miss D. E. PURVES.

Cryptogamic Secretary—D. M. HENDERSON, B.Sc.

Treasurer—J. W. H. JOHNSON, C.A.

Artist—R. EUDALL.

Auditor—C. A. SCOTT, C.A.

Editor of "Transactions"—Miss A. M. MACLEOD, Ph.D., Heriot-Watt College,
Edinburgh.

Miss ALYS SUTCLIFFE, Mr. P. GREEN, Mr. K. M. SEBASTINE, and
Dr. W. A. P. BLACK were elected Ordinary Fellows.

The PRESIDENT then delivered an address entitled "A Historical
Commentary on the Genus *Rhododendron*, based on Records in the
Royal Botanic Garden."

NOVEMBER 20, 1952.

Dr. J. M. COWAN, President, in the Chair.

The TREASURER, Mr. J. W. H. JOHNSON, C.A., submitted the following Statement of Accounts for Session 1951-1952:—

INCOME.

Annual Subscriptions for 1951-1952	£99 15 0
Arrears of Subscriptions recovered	74 5 0
<i>Transactions</i> sold	24 7 6
Interest on Invested Funds	21 0 2
Subscriptions to Publications Fund	10 3 8
Income from Botanical Society Trust Fund . . .	11 11 0
Income Tax recovered	17 13 8
Grant from Carnegie Trust	100 0 0
	<hr/>
	£358 16 0
Excess of Income over Expenditure	17 2 5
	<hr/>
	£341 13 7
	<hr/>

EXPENDITURE.

Printing <i>Transactions</i> , Vol. 36, part 1	£237 7 6
Printing and Postage of Notices for Meetings . . .	70 16 7
Stationery, Postages, etc	22 19 6
Fire Insurance on Books	0 5 0
Honorarium to Treasurer	5 5 0
Honorarium to Assistant Secretary	5 0 0
	<hr/>
	£341 13 7
	<hr/>

STATE OF FUNDS.

Life Membership Fund.

Balance at close of Session 1950-1951	£995 0 0
Add—Life Composition received	3 3 0
Transferred from Ordinary Fund	1 17 0
	<hr/>
	£1000 0 0

Ordinary Fund.

Balance at close of Session 1950-1951	£0 17 4
Add—Surplus Income for 1951-1952	17 2 5
	<hr/>
	£17 19 9
Less—Transferred to Life Membership Fund	1 17 0
	<hr/>
	16 2 9
Total Funds	<hr/>
	£1016 2 9

Being :—£200 $3\frac{1}{2}\%$ War Stock, at cost	£194 18 3
£258, 2s. 6d., British Transport 3% Guaranteed Stock, 1978-88, at cost	216 18 6
£200 3% Defence Bonds, at cost.	200 0 0
£250 3% Savings Bonds, 1965-75, at cost	253 18 3
Sum on Current Account with Clydesdale and North of Scot- land Bank Ltd.	157 2 9
	<hr/>
	£1022 17 9
Less—Subscriptions received in advance	6 15 0
	<hr/>
	£1016 2 9

EDINBURGH, 18th October 1952.—I hereby certify that I have audited the Accounts of the Treasurer of the Botanical Society of Edinburgh for the Session 1951-1952, and I have found them correct. I have also checked the foregoing Abstract, and find it correct. I have seen the securities for the invested funds and have found them in order.

CHARLES A. SCOTT, C.A., Auditor.

Dr. W. A. P. BLACK delivered an address entitled "Concentration Gradients and their Significance in the Brown Seaweeds."

The following papers were read by title:

1. "The Genus *Trichoderma*: its relationship with *Armillaria mellea* (Vahl ex Fries) Quél, and with *Polyporus schweinitzii* Fr., together with preliminary observations on its ecology in woodland soils," by R. S. C. AYTOUN. (See xxxvi, 99.)
2. "The Vegetation of the island of Soay, Inner Hebrides," by S. Y. BARKLEY. (See xxxvi, 119.)
3. "Some Desmids from West Highland Lochs," by E. M. LIND. (See xxxvi, 115.)

DECEMBER 11, 1952.

Dr. J. M. COWAN, President, in the Chair.

Mrs. B. L. BURTT and Mrs. D. KER were elected Lady Members.

Mr. D. N. McVEAN was elected an Ordinary Fellow.

Professor HUGH NICOL delivered an address entitled "Soil Bacteria, Food Production and Fuel Policy."

JANUARY 15, 1953.

Dr. J. M. COWAN, President, in the Chair.

Dr. C. E. FOISTER and Mr. J. M. TODD read papers entitled "Thoughts on the Nature and History of Plant Diseases."

The following papers were read by title:

1. "Observations on the Bryophyte Flora of the Isle of May," by E. V. WATSON. (See xxxvi, 165.)
2. "A Note on the Behaviour of *Ammophila arenaria* (L.) Link, in relation to Sand-dune Formation," by A. R. GEMMELL, P. GREIG-SMITH and C. H. GIMINGHAM. (See xxxvi, 132.)
3. "Contributions to the Maritime Ecology of St. Cyrus, Kincardineshire. Part III: Salt Marsh," by C. H. GIMINGHAM. (See xxxvi, 137.)

FEBRUARY 19, 1953.

Dr. J. M. COWAN, President, in the Chair.

Mrs. J. A. MACDONALD was elected a Lady Member.

Mr. D. R. MORRIS was elected an Ordinary Fellow.

The following papers were read:

1. "*Prunus cerasus* in Scotland," by Mr. B. L. BURTT.
 2. "Woods in Shetland: Past and Present," by Mr. D. H. N. SPENCE.
 3. "Studies in Seeds," by Miss E. CANAVAN and Miss S. P. B. POTTER.
 4. "Studies in a Common Disease of *Vaccinium* species," by Mr. J. HOPKINS.
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MARCH 12, 1953.

Dr. J. M. COWAN, President, in the Chair.

Mr. S. M. JAFRI and Mr. A. D. Q. AGNEW were elected Ordinary Fellows.

Miss I. GARRETT and Mr. J. C. HOPKINS were elected Ordinary Members.

Professor J. R. MATTHEWS delivered an address entitled "Pioneers and their Successors."

APRIL 9, 1953.

Dr. J. M. COWAN, President, in the Chair.

The President referred to the deaths of Professor D. H. CAMPBELL, an Honorary Foreign Fellow of the Society, and Mr. J. T. JOHNSTONE, late Assistant Secretary.

After the President had welcomed visitors from the British Ecological Society, Dr. P. H. DAVIS read a paper entitled "Plant Life in Central and North-Eastern Turkey: an illustrated Account of the Lecturer's Expedition to the Anti-Taurus and Pontic Taurus in 1952."

MAY 21, 1953.

Dr. J. M. COWAN, President, in the Chair.

Mr. R. T. HUNTER was elected an Ordinary Fellow.

Professor MARK L. ANDERSON delivered a lecture entitled "The Ecological Status of Wistman's Wood, Devonshire." (See p. 195).

JUNE 5, 1953.

Dr. J. M. COWAN, President, in the Chair.

Dr. A. F. BROOK was elected an Ordinary Fellow.

After a Demonstration of Plants in Flower in the Houses, Fellows and Members walked round the Royal Botanic Garden, under the leadership of the President.

The Botanical Society of Edinburgh is greatly indebted to the Carnegie Trust for the Universities of Scotland for a substantial grant towards the publication of this number of the *Transactions*.

TRANSACTIONS
OF THE
BOTANICAL SOCIETY OF EDINBURGH

SESSION CXVII

THE BOTANICAL SOCIETY OF EDINBURGH.

EXCERPTS FROM A SPEECH DELIVERED BY
Dr. J. M. COWAN, President,

AT A DINNER OF THE SOCIETY HELD AT THE
ST. ANDREW HOTEL, EDINBURGH.

(5th December 1952.)

It is appropriate that on this occasion something should be said about the origin and history of our Society, for it was at a convivial gathering such as this that the Botanical Society had its origin, as long ago as 1836, and it has been the delight of certain of its members ever since then to dine together from time to time.

For a summary of the early work of the Botanical Society, I would commend to you the report of the Centenary Meeting, which was held at the Royal Botanic Garden, Edinburgh, and in the Edinburgh City Chambers, in 1936. The Centenary was the last occasion on which Fellows of the Society met together for a Society Dinner. There is much to tell about the Botanical Society, even in the briefest survey. The scope of its activities is wide, covering every aspect of botanical science. In the early days men like Graham, Greville and Hutton Balfour were devoted to the study of the British Flora; they were succeeded by Watson, Babington, Druce and others. As evidence of interest in plants from other parts of the world, look, for example, at the many papers in the *Transactions*, particularly those by Sir Isaac Bayley Balfour and Sir William Wright Smith, concerned with the flora of Western China. On the cryptogamic side are papers on Algae by Greville and by West, on Fungi by Cooke and others, and on Bryophytes by Dickie, Dixon and others; the classical paper by Spruce, *The Hepaticae of South America*, occupies the whole of volume XV, and volume XXV is devoted to McVicar's work on the *Hepatics of Scotland*. Again,

scattered throughout the volumes of the *Transactions*, there are many papers dealing with plant anatomy, histology and physiology, and others of equal importance on plant geography, ecology, paleobotany and economic botany.

The Society has always maintained a close connection with students of botany at the University, and has published many lists of plants found by students, past or present, during their vacations at home and on their travels abroad, either privately or as members of important expeditions. At one time the Society offered annually to students an essay prize of £10; one of the earliest of these essays, published in 1883, dealt with the *Multinucleated Condition Seen in a Large Number of Flowering Plants*.

THE HERBARIUM OF THE SOCIETY.

In the early years the exchange of herbarium specimens was an important duty, each member of the Society being required to contribute not less than fifty species of plants, with as many duplicates as possible for distribution. A foreign member was under obligation to contribute five hundred specimens at the time of his election and three hundred annually thereafter. Under the guidance of such men as Professor Graham, Dr. Greville, Dr. Hutton Balfour, Dr. Patrick Neill and Mr. James McNab, the herbarium, thus started, grew rapidly—so rapidly, in fact, that it soon became a burden to the Society, for, in 1839, after only three years, no fewer than a hundred and fifty thousand specimens had accumulated, and accommodation became an acute problem. Arrangements were made for the material to be housed within the walls of the University, and to it was added the “College Herbarium” of some eleven thousand specimens dating from the days of Dr. John Hope. The joint collection was known as “The University Herbarium,” and the Botanical Society was its Curator. It was not long, however, till the failing health of Professor Graham and the scattering of the most keenly interested Fellows led to a great decline in the enthusiasm for amassing herbarium material. And this, perhaps, is not a matter for regret, for it is on record that in 1838 the Society received from one member alone, Robert Gardiner of Dundee, some three thousand specimens collected by him on the Perthshire mountains. Furthermore, after a visit to Ben Lawers in 1839, Professor Graham wrote: “The usual plants were found at the top, but in much smaller quantity than formerly and the specimens were miserably small. The mountain has for some years been too frequently visited by

collectors and the plants too carefully gleaned." One cannot but agree that it is fortunate that the botanist of to-day has an altered outlook.

By 1853 the University Herbarium had so much increased in size that there was room to house only the British section in the University, and the foreign collections were removed to the Royal Botanic Garden. Ten years later, when the Herbarium Rooms at the University were needed for other purposes, the rest of the herbarium was also transferred to the Garden.

It was around this nucleus that the present extensive Herbarium of the Garden was built, gradually growing under successive Regius Keepers until now, housed and cared for by Government, it has become a national asset of great importance, containing more than one and a quarter million specimens. The older collections are of considerable interest and value, but it is as representative of the flora of Western China and of the Genera *Primula* and *Rhododendron* that the Herbarium at the Royal Botanic Garden stands supreme.

THE SCOTTISH ALPINE CLUB.

Another aspect of the Society's activities was the formation of a Botanical Mountaineering Club. Membership of the Club was confined to those "who were in the habit of visiting alpine districts of Scotland for the study of Botanical Science, and who had proved themselves to be pleasant *compagnons de voyage*". No one was admitted who had not ascended, on foot, to the summit of three Scottish mountains not less than 3300 feet above sea-level. The inner circle of the Botanical Society, the Scottish Alpine Botanical Club, came into being in 1870 at Bridge of Lochay Hotel, Killin, Perthshire, with Professor Hutton Balfour, Professor Dickson, Sir Isaac Bayley Balfour and John Sadler among its ten original members. Throughout its long life the Club, until recently, has met at least once annually for an excursion of several days duration. Reports of these meetings are printed in the *Transactions*, and have added not a little to our knowledge of Scottish Botany. *Salix Sadleri*, for example, was discovered in August 1874, and *Sagina Boydii* in 1883.

THE BOTANICAL SOCIETY CLUB.

A second inner circle which I must not overlook is the Botanical Society Club, and it is appropriate that I should mention it on this occasion, because the members dined together, visiting one another's

houses and taking it in turns to act as host. This group is almost as old as the Society itself, for it was formed in the year 1838, and its members, for nearly a century, met annually on the 8th of February to celebrate the founding of the Society and to dine. The original members of the Club were those who, in 1836, had met at the invitation of Dr. Balfour at his house, 15 Dundas Street, to consider his proposal to found a Botanical Society in Edinburgh. The eleven invited guests unanimously supported the proposal—and the Botanical Society of Edinburgh was founded. Thus it is that the minutes of the first meeting of the Society are preserved, not in the annals of the Society, but among the private papers of the Club. Records of the Club are practically complete from 1838 to 1931, and it is of interest to note that ladies were admitted—as visitors—from as early as 1845.

From about 1861 the Club held a meeting in summer as well as in winter; in July of that year members were the guests of Dr. Lowe, and it is recorded that Professor Traill, who was then aged eighty, with the aid of Master George Lowe, aged four and a half, performed the interesting ceremony of planting an *Araucaria imbricata* presented by Mr. McNab. The year 1867 is noteworthy since it was then unanimously agreed that the Club should have its Poet Laureate, and it is recorded that Mr. Isaac Anderson Henry was appointed to that office, his duty being to produce, for each anniversary meeting, a composition by himself which should then be read or sung. Some of the poems find a place in the minute book. Although to-night we may lack a Poet Laureate, we have tried to follow precedent as far as possible; decorated menu cards were presented to the Club in 1877, and to-night's version is adorned, not with the original pressed specimens but with a colour photograph of the rare Australian Rhododendron, *R. Lochae*. Again, we are told, in 1879, that "the table was beautifully decorated with orchid blooms, a source of delight and interest to the members present"—and similar decorations are provided to-night. Nor is this the first occasion on which members of the Society have dined formally at a hotel, for in 1894 the Botanical Society Club visited Glasgow and dined, as guests of Professor Bower, at the Grand Hotel.

Members of the Botanical Society Club and of the Scottish Alpine Botanical Club are with us to-night, and to the Botanical Society of Edinburgh—now in its one-hundred-and-seventeenth year—and its two venerable offsets, we wish a long, a lively and a fruitful future.

REPORT OF THE CRYPTOGAMIC SECTION, 1953.

By D. M. HENDERSON.

A short afternoon foray to Tantallon on the 18th of April was attended by twenty members. Many of the common marine algae were seen on the shelving rocks, but the early spring flora was disappointingly late and little was seen in flower.

For their sixty-fifth annual autumn foray the section joined with the meeting of the British Mycological Society, in Dunkeld, from 1st to 8th September. The Birnam Institute served as a headquarters, with laboratory and display tables. An average of approximately fifty mycologists attended the excursions. On 2nd September lowland Scots Pine woods and loch margins were visited at Stormont, near Blairgowrie. The following day the meeting set forth with high hopes for the Black Wood of Rannoch. Conditions were very good and many noteworthy species were found—*Lactarius repraesentaneus*, *Gyroporus cyanescens*, *Hydnum imbricatum*, are a few from amongst a host of commoner species.

Saturday, 5th September, was spent in examining the finds of the previous day. The woods of Murthly Castle provided ample hunting grounds for Sunday. From the long list of species collected, *Omphalia postii*, *O. wyneii* and very fine material of *Otidea onotica* deserve mention. The final foray on the hot afternoon of 7th September, at the oak and birch woods and marshy ground at Loch Craiglush near Dunkeld, ended the meeting.

The following list was prepared by Dr. F. B. Hora and Mr. P. D. Orton. The more notable finds in other groups will be published in the British Mycological Society *Transactions*. The names used are in accordance with Pearson & Dennis' list except where indicated otherwise.

An afternoon foray in October, to Penicuik estate, yielded a rather poor collection, as the previous week had been wet and cold. The only noteworthy find was some fine material of *Flammula lenta*.

DUNKELD, 1ST-8TH SEPTEMBER 1953.

S=Stormont Loch; R=Rannoch; TB=Tay Banks; M=Murthly;
C=Loch Craiglush.

AMANITA CITRINA, TB, M; A. CITRINA var. ALBA, M; A. MUSCARIA, S, R;
A. PHALLOIDES, TB; A. PORPHYRIA, M; A. RUBESCENS, S, M, R, C.
AMANITOPSIS FULVA, S, M, C; A. VAGINATA, M; A. INAURATA, M.

- LEPIOTA AMIANTHINA, S, R, TB, M; L. CRISTATA, TB, M; L. GRANULOSA, M;
L. METULAESPORA, M.
- ARMILLARIA MELLEAE, M; A. MUCIDA, M, R.
- TRICHOLOMA ALBUM, M; T. ATROCINEREUM, M; T. COLUMBETTA, R, M;
T. DECORUM, R; T. EQUESTRE, R; T. FULVUM, R, C; T. FOCALIS, R;
T. IMBRICATUM, TB, C; T. MELALEUCUM, TB, M; T. PORTENTOSUM,
R; T. RUTILANS, S, R, M; T. SAPONACEUM, R; T. SCALPTURATUM, R;
T. SEJUNCTUM, M; T. SORDIDUM, M; T. TERREUM, TB; T. USTALE, S;
T. VIRGATUM, TB, M.
- CITOTOCYBE AURANTIACA, R, M, S; C. CLAVIPES, R, TB, M, S, C; C. CONNATA,
M; C. DIATRETA, S; C. FRAGRANS, M, C; C. INFUNDIBULIFORMIS, TB, C, M;
C. OBSOLETA, TB; C. UMBONATA, S, TB; C. VIBECINA, M.
- LACCARIA LACCATA, TB, M, S, C; L. AMETHYSTINA, TB, M, C; L. PROXIMA,
M, S; L. TORTILIS, M.
- MYCENA ALCALINA, R, M; M. AMMONIACA, M, R, S, C; M. AMICTA, M; M.
EPIPTERYGIA, M, R, S, C; M. GALERICULATA, M, R, C; M. GALOPUS,
M, R, C; M. METATA, M; M. POLYGRAMMA, M, C; M. PURA, TB, M;
M. PSEUDOPURA, M; M. ROSELLA, R; M. SANGUINOLENTA, M, R, S, C;
M. SPEIREA, C; M. STYLOBATES, M; M. VISCOSA, S, R; M. VITILIS,
C, M.
- COLLYBIA AMBUSTA, TB; C. BUTYRACEA, C; C. CIRRHATA, R, S; C. CIRRHATA
var. COCKEI, R, S; C. DISTORTA, M; C. MACULATA, M, R, S; C. PLATY-
PHYLLA, M; C. RADICATA, M; C. VELUTIPES, M.
- MARASMIUS ANDROSACEUS, M, S; M. CANDIDUS, C; M. CAUTICINALIS, R;
M. DRYOPHILUS, M, R, C; M. OREADES, M, S; M. PERONATUS, TB, M, C;
M. RAMEALIS, M, S, C; M. ACERVATUS (sensu Favre), R.
- OMPHALIA ASTEROSPORA, M; O. CLUSILIFORMIS Kuhn. et Rom., M; O. FIBULA,
TB, M; O. POSTII, M; O. UMBELLIFERA, R; O. UMBILICATA, M, R;
O. WYNNI, TB, M.
- PLEUROTUS PORRIGENS, R.
- PANUS STIPTICUS, M.
- NYCTALIS PARASITICA, M.
- HYGROPHORUS CHLOROPHANUS, M, TB; H. COCCINEUS, TB, M, R; H. CONICUS,
M, R, S; H. COSSUS, M; H. FORNICATUS, M; H. LAETUS, R; H. MINIATUS,
R, S; H. NITRATUS, TB; H. NIVEUS, M; H. PRATENSIS, TB, M;
H. PSITTACINUS, TB, M; H. PUNICEUS, R; H. PUSTULATUS, M, C.
- LACTARIUS BLENNIUS, M, TB; L. CAMPHORATUS, R; L. DECIPiens, R, M;
L. DELICIOSUS, R; L. FULIGINOSUS, R; L. GLYCOSMUS, R, M; L. HELVUS,
R; L. MITISSIMUS, R, M; L. OBSCURATUS, C; L. PALLIDUS, TB; L.
PLUMBEUS, R, M; L. PYROGALUS, M; L. QUIETUS, R, C; L. REPRÆSENT-
ANEUS, R; L. RUFUS, R, M, C, S; L. SCROBICULATUS, R; L. SERIFLUUS,
R, M; L. SPINOSULUS, R, M; L. SUBDULOUS, R, M, TB; L. TABIDUS, M;
L. TORMINOSUS, R, C; L. TRIVIALIS, R; L. UVIDUS, R; L. VELLEREUS,
R, TB, M; L. VIETUS, R, TB, C, S; L. VOLEMUS, R.
- RUSSULA ADUSTA, TB; R. AERUGINEA, R; R. ATROPURPUREA, M; R. BRUN-
NEO-VIOLEACEA, M; R. CLAROFLAVA, C; R. CAERULEA, R; R. DELICA, R;
R. DRIMEIA, R; R. EMETICA, R, TB, M, S; R. FALLAX, R; R. FELLEA,
R, TB, M; R. FOETENS, R, TB; R. FRAGILIS, R; R. NIGRICANS, R, M;
R. OCHROLEUCA, TB, M; R. QUELETII, R; R. SANGUINEA, R; R. SORORIA,
M; R. VELENOVSKYI, S; R. VENOSA, R, M, S; R. VESCA, R, TB, M;
R. XERAMPHELINA, R.
- CANTHARELLUS CIBARIUS, TB, M, R, S, C; C. LUTESCENS, R; C. TUBAEFORMIS,
R, S.
- CRATERELLUS CORNUCOPIOIDES, TB.
- PLOCATIA CRISPA, M.

- PLUTEUS CERVINUS, TB, R, C, S.
 CLITOPILUS PRUNULUS, M, R.
 ENTOLOMA JUBATUM, R, TB, M; E. NITIDUM, S; E. PORPHYROPHAEUM, M;
 E. RHODOPOLIUM, M, C, R, S; E. SERICEUM, M.
 LEPTONIA ASPRELLA, C; L. CHALYBAEA, R, M; L. FORMOSA, S; L. LAMPROPUS,
 R, M; L. SERRULATA, M; L. SERICELLA, TB, M, S.
 NOLANEA CETRATA, M, S; N. JUNCEA, M, C; N. PAPILLATA, S; N. STAURO-
 SPORA, S, R.
 PHOLIOTA EREBIA, M; P. FLAMMANS, M, R; P. MUTABILIS, C; P. SPECTABILIS,
 TB; P. SQUARROSA, TB, M; P. TOGULARIS, M.
 ROZITES CAPERATA, R.
 HEBELOMA CRUSTULINIFORME, TB, C, M.
 FLAMMULA ALNICOLA, C; F. CARBONARIA, M; F. LIMULATA, S; F. PENETRANS,
 TB, M, R, C.
 NAUCORIA CUCUMIS, TB, M; N. ERINACEA, S; N. ESCHAROIDES, C; N. MYOSOTIS,
 R, C; N. SCOLECINA, C.
 TUBARIA CONSPERSA, TB, M.
 GALERA BADIPIES, M; G. CLAVATA, M; G. HYPNORUM, TB; G. MYCENOPSIS,
 M, S; G. PALUDOSA, C; G. RUBIGINOSA, M, S; G. TENERA, TB, M, R;
 G. TIBICYSTIS Atk., R.
 CREPIDOTUS VARIABILIS, M; C. MOLLIS, Ben Lawers.
 BOLBITIUS VITELLINUS, M.
 CORTINARIUS ACUTUS, R; C. ANOMALUS, R, S, C; C. ANOMALUS var. LEPIDOPUS,
 R; C. ARMILLATUS, R, S, C; C. AZUREUS, C; C. BOLARIS, M; C. BIVELUS,
 C; C. BRUNNEUS, R; C. CALLISTEUS, R; C. CINNAMONEUS, R, S, C; C.
 CINNAMONEUS var. PALUDOSA, C; C. DELIBUTUS, S; C. ELATIOR, R, M;
 C. ERYTHRINUS, M; C. EVERNIUS, R; C. FLEXIPES, C; C. GENTILIS, R;
 C. HELVOLUS sensu Bresadola, C; C. HEMITRICHUS, M; C. OBTUSUS, S;
 C. PALEACEUS, M; C. PARVANNULATUS Kuhn., C; C. PHOENICEUS, R;
 C. PHOLIDEUS, C; C. PORPHYROPUS, S; C. RIGIDUS, C; C. RUBRICOSUS, C;
 C. SEMISANGUINEUS, R, S; C. TABULARIS, C; C. TRAGANUS, R; C.
 TRIUMPHANS, R, C; C. VENETUS, R; C. VIBRATILIS, R.
 INOCYBE CINCINNATA, M; I. DECIPIENTOIDES, S; I. DULCAMARA, C; I.
 FASTIGIATA, TB; I. GEOPHYLLA, M, C; I. GEOPHYLLA var. LILACINA, M;
 I. HYSTRIX, TB; I. LACERA, R; I. MACULATA, M; I. MIXTILIS, M; I.
 PUTILLA, C.
 PAXILLUS ATROTOMENTOSUS, TB, R; P. INVOLUTUS, M, S, C; P. PANCOIDES, S.
 STROPHARIA AERUGINOSA, TB; S. SEMIGLOBATA, M, R.
 HYPHOLOMA COTONEUM, M; H. EPIXANTHUM sensu Kuhnert & Romagnesi, M;
 H. FASCICULARE, TB, M, S; H. HYDROPHILUM, R, S; H. PYRRHOTRICHUM,
 M; H. SUBLATERITIUM, M; H. VELUTINUM, M.
 PSILOCYBE ELONGATA, C, S, R; P. FOENISECII, M; P. SEMILANCEATA, TB, M,
 S; P. UDA, S.
 PSATHYRELLA GOSSYPINA (sensu Lange), M, R, S; P. OBTUSATA (sensu Lange),
 TB, M.
 PANAEOLUS ACUMINATUS, M, C; P. ATER, S; P. CAMPANULATUS, M.
 PSALLIOTA AUGUSTA, M, TB; P. ARVENSIS, M; P. CAMPESTRIS, M.
 COPRINUS ATRAMENTARIUS, TB, M, C; C. COMATUS, M; P. LAGOPUS, TB, M;
 C. MICACEUS, R, TB, M; C. PICACEUS, TB; C. PLICATILIS, M, C;
 C. RADIANUS, M.
 GOMPHIDIUS GLUTINOSUS, R; G. ROSEUS, R, S; G. RUTILUS, S.
 GYROPORUS CYANESCENS.
 BOLETUS BADIUS, S; B. BOVINUS, R, S; B. CALOPUS, R; B. CHRYSENTERON,
 R, TB, M; B. EDULIS, S; B. ELEGANS, R, M, C; B. ERYTHROPUS, TB;
 B. FELLEUS, M; B. FLAVIDUS, R; B. HOLOPUS, R; B. LUTEUS, R, M, S;

- B. PIPERATUS, S, M; B. PULVERULENTUS, TB; B. SCABER, R, M, S, C;
 B. SUBTOMENTOSUS, TB, M; B. VARIEGATUS, S, R; B. VERSIPELLIS, R, S.
 FISTULINA HEPATICA, TB.
 POLYPORUS ADUSTUS, TB, M; P. ALBIDUS, TB; P. BETULINUS, R, M, S, C;
 P. CAESIUS, M; P. GIGANTEUS, TB; P. NIDULANS, S; P. PERENNIS, TB,
 S; P. RADIATUS, M, S; P. SCHWEINITZII, R, M, S; P. SQUAMOSUS, R, M;
 P. SULPHUREUS, C; P. VARIUS, Ben Lawers.
 LENZITES SEPIARIA, R; L. ABIETINA, M.
 FOMES ANNOSUS, TB, M, S; F. FOMENTARIUS, R, TB, M.
 POLYSTICTUS ABIETINUS, TB, S; P. VERSICOLOR, TB, M, S.
 TRAMETES MOLLIS, M.
 MERULIUS TREMELLOSUS, M.
 PORIA VERSIPORA, M.
 HYDNUM FRAGILE, R; H. IMBRICATUM, R; H. REPANDUM, R, TB, C;
 H. FERRUGINEUM, R.
 THELEPHORA TERRESTRIS, R, M, S.
 STEREUM HIRSUTUM, R, TB, M; S. PURPUREUM, TB, M, C; S. RUGOSUM, TB.
 PENIOPHORA QUERCINA, M.
 SPARASSIS CRISPA, S, R.
 CLAVARIA CINEREA, M; C. CRISTATA, R; C. INAEQUALIS, TB; C. RUGOSA, M, S;
 C. FLACCIDA, S.
 CALOCERA VISCOSA.

GASTEROMYCETES.

- BOVISTA PLUMBEA, R.
 LYCOPERDON ECHINATUM, R, TB, M, S; L. GEMMATUM, R, TB, M, S;
 L. PYRIFORME, TB.
 SCLERODERMA VULGARE, TB, C; S. CEPA, TB.
 SPHAEROBOLUS STELLATUS, R.
 NIDULARIA PISIFORMIS, R.
 PHALLUS IMPUDICUS, M, S, C.

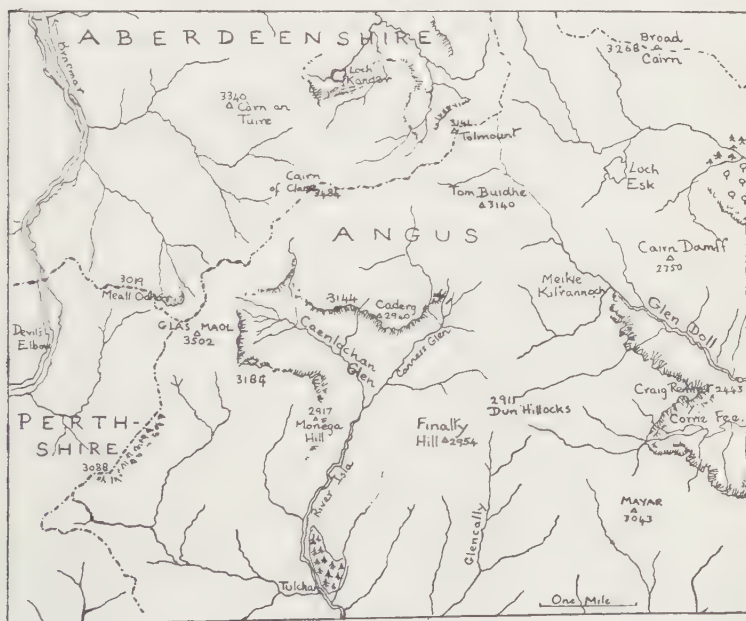
THE FLORA OF CAENLOCHAN.

By J. GRANT ROGER.

(The Nature Conservancy, Edinburgh.)

(Read 17th April 1952.)

The corrie of Caenlochan is situated on the eastern side of Glas Maol (3502 ft.), the highest mountain in Angus, near the borders of Aberdeenshire and Perthshire (see Map). The corrie is bounded mostly by an imposing rampart of steep crags broken in places by



TOPOGRAPHY OF CAENLOCHAN

gullies usually occupied by streams forming the head-waters of the River Isla, one of the main tributaries of the Tay. The steepest rocks are mainly about the head of the corrie, and fall, interrupted by ledges, from near the 3100-foot contour for 400 or 500 feet to the boulder-strewn slopes and wet moorland below. Although much of the higher ground above the edge of the corrie is rather dry and stony there are considerable areas of boggy land, particularly near

the Aberdeen-Angus boundary fence. This boundary is crossed at 3158 feet by the old Monega Pass, linking Glen Isla with Braemar, and distinguished as the highest public path in Britain, reaching as it does a height of 3318 feet on the shoulder of Glas Maol, just above Caenlochan.

From the botanical point of view the most important features at Caenlochan are the cliffs consisting of graphitic- and mica-schists of the Dalradian series generally similar to those on Ben Lawers, Beinn Heasgarnich, Beinn Laoigh and several other mountains of the Grampian Range long famous for the richness of their floras. The graphitic- and mica-schists just mentioned are associated with quartz and hornblende schists, particularly at the head of the corrie where there are also considerable bands of porphyry. These rocks present a series of ridges, ledges and screes, supporting in all a vegetation of great diversity and interest but showing most luxuriance on the graphitic- and mica-schists which break down into a soil evidently very favourable to the plants.

The climate of the Caenlochan area is distinctly drier than that prevailing over most of the Scottish Highlands. The average annual rainfall on Glas Maol is *c.* 60 inches, in contrast to the markedly wetter conditions over the central and western Grampians. (On Ben Lawers the average annual rainfall is *c.* 90 inches; on Beinn Laoigh *c.* 120 inches.) Indeed, the climate of the eastern Grampians approaches more nearly that of the arctic than does the climate of any other high-mountain area in Britain, and this is doubtless an important factor (in conjunction with suitable geological conditions) favouring the persistence of at least some of the arctic-alpine plant species found locally in the Clova-Caenlochan region of Angus and in neighbouring areas of Aberdeenshire.

The rocks at Caenlochan bearing the richest flora have an easterly or north-easterly exposure, corresponding in fact to the exposure favoured generally by our Scottish mountain plants inhabiting the higher corries. As a rule, snow lies quite heavily on the eastern slopes of Glas Maol from December to April, and in the gullies and hollows most sheltered from the sun considerable snow patches tend to persist until May or even June. Many of the ledges and screes are well sheltered from the prevailing westerly winds, but strong and often bitterly cold easterly winds reach, unhindered, almost every part of the corrie.

Caenlochan has for long been known as an area particularly favoured by many of the rarer species of the Scottish mountain flora; indeed the corrie was most probably first explored botanically

by the tireless George Don (1764-1814), who, in his own words, "repeatedly ranged over the great mountains of Angusshire". Most of the species referred to below were discovered in the corrie more than a century ago, but the records are somewhat scattered in botanical literature and in herbaria. The following account, based largely on the writer's field notes, concerns the vascular plants found within the corrie mainly between the 2500-feet and 3100-feet contours.

Apart from the many species common in the lowlands, but often reaching great elevations, the characteristic mountain plants of Caenlochan may be referred to four of the geographical groups distinguished by Matthews (1937). These are: (1) the Arctic-Alpine Element, common to the arctic regions and the mountains of central Europe; (2) the Arctic-Subarctic Element, found chiefly north of the Baltic and absent from central Europe; (3) the Alpine Element, of the mountains of central and south Europe but absent from the Arctic; (4) the Northern-Montane Element, widespread in north Europe but favouring mountains in central and south Europe.

These geographical groups or elements are represented at Caenlochan as follows:

ARCTIC-ALPINE ELEMENT.

ALCHEMILLA ALPINA L.	GENTIANA NIVALIS L.
ASPLENIUM VIRIDE Huds.	GNAPHALIUM SUPINUM L.
ATHYRIUM ALPESTRE (Hoppe) Rylands.	JUNCUS CASTANEUS Sm.
CAREX ATRATA L.	J. TRIGLUMIS L.
C. BIGELOWII Torr.	LUZULA SPICATA (L.) DC.
C. CAPILLARIS L.	LYCOPODIUM ALPINUM L.
C. LACHENALII Schkuhr	L. ANNOTINUM L.
C. VAGINATA Tausch	L. SELAGO L.
CERASTIUM ALPINUM L.	OXYRIA DIGYNA (L.) Hill
CICERBITA ALPINA (L.) Wallr.	PHLEUM COMMUTATUM Gaud.
CRYPTOGAMMA CRISPA (L.) Hook. & Bauer	POA ALPINA L.
CYSTOPTERIS MONTANA (Lam.) Desv.	P. GLAUCA Vahl *
DRABA INCANA L.	POLYGONUM VIVIPARUM L.
DRYAS OCTOPETALA L.	POLYSTICHUM LONGITIS (L.) Roth
EMPETRUM HERMAPHRODITUM (Lange) Hagerup.	POTENTILLA CRANTZII (Crantz.) Beck.
EPILOBIUM ALSINIFOLIUM Vill.	SAGINA SAGINOIDES (L.) Karst.
E. ANAGALLIDIFOLIUM Lam.	SALIX HERBACEA L.
ERIGERON BOREALIS (Vierh.) Simmons	S. LAPPONUM L.
ERIOPHORUM ANGUSTIFOLIUM Honch.	S. MYRSINITES L.
E. VAGINATUM L.	S. RETICULATA L.
	SAUSSURIA ALPINA (L.) DC.
	SAXIFRAGA AIZOIDES L.

* *Poa balfourii* Parn., also found at Caenlochan, appears to be confined to Britain. It is very closely related to *P. glauca*.

S. NIVALIS L.
 S. OPPOSITIFOLIA L.
 S. STELLARIS L.
 SEDUM ROSEA (L.) Scop.
 SIBBALDIA PROCUMBENS L.
 SILENE ACAULIS L.
 THALICTRUM ALPINUM L.

TOFIELDIA PUSILLA (Michx.) Pers.
 VACCINIUM ULIGINOSUM L.
 V. VITIS-IDAEA L.
 VERONICA ALPINA L.
 V. FRUTICANS Jacq.
 WOODSIA ALPINA (Bolton.) S. F.
 Gray

Most of the above species belonging to the Arctic-Alpine Element are among the rarer members of the British Flora and merit careful protection. *Cicerbita alpina* (*Mulgedium alpinum* (L.) Less.) persists elsewhere only in a neighbouring glen in Angus and on Lochnagar in Aberdeenshire, while *Gentiana nivalis* is restricted to Caenlochan and to a few mountains in the Breadalbane district of Perthshire. Several of the other species are found very locally on the Grampians.

ARCTIC-SUBARCTIC ELEMENT.

ALOPECURUS ALPINUS Sm.
 CAREX AQUATILIS Wahlenb.
 C. RARIFLORA Wahlenb.
 CERASTIUM EDMONDSTONII (Wats.)
 Murb. & Ostenf.

COCHLEARIA MICACEA E. S. Marshall
 RHINANTHUS BOREALIS (Sterneck)
 Marshall
 RUBUS CHAMAEMORUS L.
 SALIX LANATA L.

These species occur mainly on the higher ground about the head of the corrie, the two sedges being sometimes associated in boggy places above 3000 feet. *Salix lanata* is represented by three or four beautiful shrubs which here bear their catkins in late May or early June. Although this willow is conspicuous on the several Scottish mountain crags where it still persists, probably not more than a few dozen specimens are left in the country.

ALPINE ELEMENT.

CHELERIA SEDOIDES L.
 THLASPI ALPESTRE L.

SAXIFRAGA HYPNOIDES L.

The first two species representing this purely alpine group are common over many parts of the Highlands, but *Thlaspi alpestre* is comparatively rare and local, and has at Caenlochan probably its most northerly station on the mainland of Britain. It occurs very sparsely on the micaceous schists up to at least 2900 feet.

NORTHERN-MONTANE ELEMENT.

ALCHEMILLA FILICAULIS Buser
 A. GLABRA Neygenfind
 RUBUS SAXATILIS L.

THELYPTERIS DRYOPTERIS (L.)
 Slosson
 TRIENTALIS EUROPAEA L.
 TROLLIUS EUROPAEUS L.

Trientalis europaea may be found up to at least 3150 feet, with *Nardus stricta* L. and *Galium hercynicum* Weigel. on the more gradual slopes above the north-west end of the corrie. This species is common in many woods of the Highlands, but is also frequent on open hill-sides, and flowers at even 3500 feet on Lochmagar. *Trollius europaeus* is often very prominent at Caenlochan on damp rocky ledges between c. 2600 feet and c. 2900 feet. It reaches considerable altitudes in some of the great corries of the Grampians, its highest station known to the writer being at 3700 feet on Braeriach.

HIERACIA.

The Hieracia of the Scottish Highlands, many of which appear to be endemic, cannot readily be placed in the geographical groups referred to above. Those recorded for Caenlochan include the following species and varieties recognised by Pugsley (1948):

HIERACIUM DISSIMILE Lindbg.	H. PILOSELLA L. var. CONNOCINNATUM Hanb.
H. EXIMIUM Backh.	H. PILOSELLA L. var. TRICHOSCAPUM (N.P.) Pugsl.
H. FLOCCULOSUM Backh.	H. SENESCENS Backh.
H. HANBURYI Pugsley	H. VARIICOLOR Dahlst. ex Stenstr.
H. HOLOSERICEUM Backh.	var. PILIGERUM Pugsl.
H. JOVIMONTIS (Zahn) Roffey	H. VENNICONTIUM Pugsl.
H. PETROCHARIS (Lint.) W. R. Lint.	
H. PICTORUM Lint.	

James Backhouse, jun., who named four of the hawkweeds listed above, was one of the earliest botanists to explore Caenlochan. In company with his father, he discovered in the corrie *Cystopteris montana* and other rare species.

Associated with the characteristically mountain plants of the above groups are many other species generally widespread over the Scottish Lowlands, but frequently found also at high elevations. At Caenlochan some of these are represented in places by definite sub-species, e.g. *Caltha palustris* L. ssp. *minor* (Mill.) Clapham, *Festuca ovina* L. ssp. *viripara* (L.) Sm., and *Veronica serpyllifolia* ssp. *humifusa* (Dicks.) Syme.

Prominent on the rock ledges are *Angelica sylvestris* L., *Anthyllis vulneraria* L., *Campanula rotundifolia* L., *Cirsium heterophyllum* (L.) Hill, *Coeloglossum viride* (L.) Hartm., *Deschampsia caespitosa* (L.) Beauv., *Heracleum sphondylium* L., *Lotus corniculatus* L., *Luzula sylvatica* (Huds.) Gaud., *Melandrium dioicum* (L.) Coss & Germ., *Orchis mascula* L., *Pyrola rotundifolia* L., and *Solidago virgaurea* L. *Sorbus aucuparia* L. is established on some of the higher cliffs at

about 3000 feet, while *Larix decidua* Mill. (spread naturally from plantations in the vicinity) occurs in stunted form up to an elevation of 2950 feet (Roger, 1941).

INTRODUCED PLANTS.

It is reported (White, 1885) that seeds of *Myosotis alpestris* F. W. Schmidt (from cultivated Ben Lawers plants) and other alpine plants were sown at Caenlochan; and indeed *Myosotis alpestris* has been occasionally observed (Stuart, 1881) in the corrie from 1880 onwards—certainly up to 1950. Other species which have appeared, presumably as a result of the sowing of seed reported by Dr. Buchanan White, are *Erinus alpinus* L., seen definitely in 1880 but not later, *Aquilegia pyrenaica* DC., observed first in 1916, and *Primula auricula* L. in 1939.

An account of the occurrence of *Primula auricula* at Caenlochan, with detailed references to the three other species just mentioned, has already been published in the *Transactions of the Botanical Society of Edinburgh* (Matthews, 1940).

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THE ECOLOGICAL STATUS OF WISTMAN'S WOOD, DEVONSHIRE.

By M. L. ANDERSON.

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(With Plate VIII.)

(Read 21st May 1953.)

There is a very small wood in South Devon, on the slopes of Crockern Tor, Dartmoor, not far from Princetown, which is known as Wistman's Wood or Welchman's Wood, and which has been placed on a pinnacle of some importance by ecologists, one of whom (Tansley, 1939) has stated that it "has probably as good a claim to be considered a virgin wood as any in the British Isles". Its importance lies in the fact that it consists entirely of pedunculate oaks, apart from minor woody species, and, as it lies at an altitude of from 1200 to 1400 feet, it has been presumed to be "a remnant of extensive valley-side woods, most of which were destroyed by tin miners", and to owe "its preservation to the trees being rooted between granite boulders".

It is a curious fact that nowhere else in these islands — apart from two small areas in the Lake District — has any scrubby remnant of pedunculate oak-wood been found. The tests, laid down by botanical authorities, by which it may be known what trees ought to be considered as truly indigenous are : (a) that they grow in large masses and spread over a considerable area ; (b) that such masses never end abruptly, except where there is a sudden change of soil or substratum ; and (c) that the trees or shrubs ripen their seeds kindly, and, when these seeds are dropped, they spring up freely. It is thus a matter of some importance that surviving examples of scrubby pedunculate oak-wood, not ending abruptly but, as it were, petering out at the highest altitudinal limit of tree-growth, should be found.

Wistman's Wood, together with Pile's Wood and Black Tor Bears or Copse, the upper edge of which is said to reach an altitude of 1530 feet, seemed to provide such examples, and the first-mentioned in particular has been most carefully described, measured and photographed by several ecologists. Tansley, in *The British Islands and their Vegetation* (1939), gives an excellent summary of various papers,

together with several photographs which furnish a clear and vivid picture of this unique wood and its surroundings. The wood is peculiar in more ways than one. Tansley himself admits that it "occurs in a region of high rainfall (estimated at 67·70 inches) and in a very exposed position between 1200 and 1400 feet altitude, on shallow and markedly acid soil—under conditions, in fact, which we commonly associate with sessile oak. Nevertheless, it is a pure *Quercus robur* wood, certainly emphasising the fact that this species can maintain itself in such a habitat."

At first the well-substantiated occurrence of this remarkable wood seems to present an insurmountable stumbling-block to the acceptance of the theory, which I have put forward, that the pedunculate oak is not indigenous in the British Isles. However, its occurrence seemed to be so anomalous in every respect that I began to consider ways and means whereby it could have originated artificially, and a number of fortuitous circumstances ultimately led me to what I believe to be a perfectly good and simple explanation of its origin. This explanation was largely based on the detailed information supplied by the ecologists mentioned, but a personal visit to the wood has strengthened my views. Briefly, I believe that the present oak-woods represented by Wistman's Wood, Pile's Wood and Black Tor Bears have risen *artificially*, through the action of birds, as the possibility of their having arisen through man's direct action seemed to be quite ruled out. Incidentally, in putting forward this suggestion, I should like to draw attention to a very grave omission on the part of the majority of ecologists in this country—their neglect of the part played by birds in the dissemination of plants. Thus, birds are mentioned only three times in *The British Islands and their Vegetation*, and in no case is reference made to the important part which they may play in nature in scattering seed.

SURVEY OF LITERATURE IN RESPECT OF WISTMAN'S WOOD.

Carrington (1757).—The first reference to Wistman's Wood is a fanciful one from the poem *Dartmoor* by Carrington, in which we are informed that Crockern Tor was the meeting-place of the ancient administrators of the forest law. The application of the forest law to this area does not necessarily imply that there were any trees on the Tor.

Burt (1826).—The second edition of Carrington's poem has a description of the wood by W. Burt. Two quotations are of interest in this connection. The first reads: "None of these venerable

foresters exceeds seven feet in height, but their circumference is great in proportion, being nearly the same. Their boughs and branches are tangled with moss, thorns, brambles and other parasites, the seeds of which, *conveyed thither by birds*, have found a strange but convenient nidus." Again, Burt notes that "tradition relates that Wistman's otherwise Welchman's Wood was planted by the renowned Isabella de Fortibus, Countess of Devon". This was the lady who richly endowed Buckland Abbey in 1291.

Martyn (1807).—There is a reference to the wood in Martyn's edition of Miller's *Gardener's Dictionary* (1807), which is apparently extracted from the *Agricultural Report of the County of Devon*, one of a series written about ten years earlier for all the counties of Britain.

"Dartmoor, though denominated as Forest, has little or no wood. The only natural wood is Wistman's Wood, near Crockern Tor, the seat of the parliament of the Stannaries. It consists of huge decayed stumps of trees amidst loose rocks of granite; on their decayed tops thorns, brambles, etc. are shooting forth, forming altogether a most grotesque appearance."

If this is a reliable description, it is quite different from that of Borrer, in 1833, and from recent descriptions. It is noteworthy that the trees are described as decayed stumps, and that there are thorns, brambles, etc., which have disappeared by 1932. It is just possible that there were, in 1790, still a few decayed stumps of an earlier generation of aboriginal sessile oaks, which half a century later had vanished from sight but which were then in fact covered by obvious remnants of the original oak-wood association—thorns and brambles. Or was the description of the late eighteenth-century reporter purely fanciful?

Loudon (1838).—Of Wistman's Wood Loudon writes: "Near this spot, tradition says, were anciently some old oaks, under which the Britons held their courts, and under which a conference took place between Saxons and Britons. The oak trees, though the place is still called Wistman's or Welchman's Wood, have long since been cut down, though there are still some huge gnarled stumps amidst loose rocks of granite; and on their decayed tops thorns, brambles, etc., are shooting forth, forming altogether a most grotesque appearance. These distorted and stunted remains, we are informed by Borrer, are all *Q. pedunculata*, and some idea may be formed of their appearance from the engraving given of them by Burt, in his notes to the second edition of Carrington's Dartmoor. The trees in this wood are now none of them above 7 feet high, though their trunks are more than 10 feet in circumference."

Loudon then quotes Borrer's description (1833) as follows : "Wistman's Wood is still in existence. It is something more than a mile north of Two-Bridges, near the centre of Dartmoor, where it forms a narrow stripe, a quarter of a mile at least in length, along the western slope of the hill at the foot of which runs a mountain brook, one of the branches of the West Dart. On the ridge of the hill are the Little Bee and the two Longaford Tors (the Great Longaford being a building-place of the raven), and the Crockern Tor, interesting to antiquaries, is on a lower part a little to the south-east. A few of the trees are scattered, but by far the greater part are perched, as it were, among low blocks of granite that lie in abundance on the hill-side; the gnarled and twisted stems reclining in the spaces between the rocks and formed into an undistinguishable mass with them by a thick mat of mosses and lichens. . . . I did not observe stems of any large size, but they display incontestable marks of great antiquity. The branches rise a very few feet above the rocks and their twigs are very short, yet I found on them a tolerably vigorous crop of leaves and acorns."

The decayed stumps have now become stems.

Froude (1838).—Through the Duke of Bedford, Loudon was able to secure from Archbishop Froude, vicar of Dartington, near Totnes, further information about the wood as follows : "I have been told that there is an ancient record in the Duchy office, which probably refers to their existence, not long after the Conquest. On the bottom stock of one of them, cut down for the purpose, I counted upwards of 250 concentric rings, when the further evidence of annual formations in the exterior circumference was too indistinct to be noticed. . . . The extent of Wistman's Wood is about two acres."

Baring-Gould (1907).—In his descriptive guide-book entitled *Devon*, S. Baring-Gould has a few very brief notes on the wood : "At Wistman's Wood are very ancient stunted oaks that spread wide but attain no height. They were mentioned in Doomsday."

Elwes (1907).—Referring to Wistman's Wood in *The Trees of Great Britain and Ireland*, Elwes contributes some new facts : "It contains a number, perhaps a thousand, of the most stunted and dwarf oaks in existence, growing among granite boulders in a very exposed and windy situation. . . . In September, 1868, Mr Wentworth-Buller obtained leave from the Prince of Wales to cut down one of these trees in order to find out its age. One section was sent to Kew, and another, now in Mr Amory's possession, at Druid, Ashburton, is 9 inches by 7 inches in diameter and shows 163 years' growth, with distinctly-marked medullary rays and several deep shakes. The

bark is extremely thin, probably owing to the thick coat of moss and lichen which covered it. The slowness of growth in this tree is remarkable, no less than forty years to the inch."

Tansley (1939).—Brief reference has already been made to *Tansley*; further information from his book is as follows: "The oldest trees in Wistman's Wood have been estimated on fairly good grounds to have an age of about 500 years. Those in the other two woods, where cutting once took place, are probably not so old." *Tansley* then quotes *Christy's* description (1922), from which it appears that the total area of Wistman's Wood is four acres, lying on the west-facing slope (left bank) of the valley of the West Dart two miles north of Two Bridges.

"The three fragments of which Wistman's Wood consists lie between elevations of about 1200 and 1300 feet. They are all based on the conglomeration of angular masses of granite, locally known as clatter, which occupies the strip of hillside between the grass-moor above and the valley bottom below. It is evident from the small outlying fragments of scrub that the wood once formed a continuous belt along the side of the valley coincident with the strip of clatter.

"The floor of the wood is extremely irregular, being formed of the uneven surfaces of the great masses of granite with deep crevasses between the whole, masked by a thick covering of bryophytes and vascular plants, so that most of the wood can only be penetrated by cautious crawling over the granite masses. Here and there are small areas of comparatively level ground.

"The patches of wood are composed almost entirely of dwarf trees of *Quercus robur*. Most of the oaks are much distorted, with thick procumbent trunks and main branches lying on or between the rocks, and rising only 8–15 feet in the vertical height of their tallest aerial shoots. A few individual trees are 20–25 feet high with thick erect trunks and wide-spreading crowns."

Measurement showed that the average height of the trees was 14 feet 7 inches and the maximum 20 feet; the average girth was 48 inches and the maximum girth 102 inches. The tallest tree in the wood was $26\frac{1}{2}$ feet high. Although there is no distinct shrub layer, the tree and shrub vegetation is of especial interest ecologically, with *Q. robur* dominant, *Sorbus aucuparia* occasional-frequent, *Salix atrocinerea* occasional, and *Ilex aquifolium* rare. Ivy and honey-suckle are frequent. It was remarked that the oaks in and around the wood, especially the younger ones, frequently produce long, stout, sappy, annual shoots, often one or even two feet long. Most of these are killed (by frost or wind) in the first year, but a few persist and

lead to rapid growth of the young saplings. The younger oaks are said to be perfectly healthy plants, though stunted by the severe conditions of this existence.

“Regeneration. It is clear that the wood actually does regenerate, for there are numerous young saplings just outside it, especially along its upper (most protected) edge, but also here and there in the clatter at some little distance from the wood; and acorns are quite freely produced on the older trees. Not all of these can ripen, for those seen in the most exposed (northern) patch of the wood were still quite small—not half-grown—on 15th September 1932, but clearly some do. There are no seedlings on the lower half of the wood towards the stream, where there is more grass and more animals feed. Dung of the ponies, sheep and cattle pastured on the moor was seen right up to the edge of the wood, but no evidence was found that they eat off the young seedlings. The highest altitude (430 m.) and the most exposed position reached by the oaks from the wood is a patch of clatter 150 metres to the north-east of the northern patch of wood. In this are three good shrubby oaks 4 feet high, one with an erect trunk 4 inches thick at the base, and one rowan 7 feet high, but thin and evidently suffering.”

STATUS OF WISTMAN'S WOOD IN 1953.

Observations made by myself on the occasion of a visit to the wood in spring revealed that the detailed description given by Christy still holds. The wood was much scrubbier, but less blasted than I had expected, probably owing to the recent flush of green leaves. The so-called clatter forms rather a pronounced ridge lying almost parallel with the stream, at some distance from it. Along this ridge the largest granite blocks occur, and the size of the blocks decreases in all directions from this centre. There are several underground streams under the main ridge. While all the oaks seemed to be pedunculate, some had flushed earlier than others, and some had atypical leaf-forms. Some large acorn-cups and one or two small clusters of cups—all on short stout stalks—were found under two trees.

Rowan trees are not infrequent in the wood, with a higher proportion in the clatter towards the north. The hollies seen had very broad bases and were obviously very old—one carried berries.

Contrary to what Christy says, there are zones of smaller, presumably younger, oaks between the largest oaks on the crest and the stream. These are straighter and less gnarled than the older



1



2

1. Oak and rowan, growing fifty yards to the north-east of the main block, specifically mentioned by Christy in 1922. Also shows typical clatter.

2. The oak growing farthest to the north, fifty yards from the trees in fig. 1 and a hundred yards from the main block, showing typical location. Note the match-box.

trees. Damage is being done by animals wherever the shoots reach above the rocks; this persists until the shoots manage to rise out of reach and form a crown, which usually leans markedly from the wind.

Areas around the main block were carefully examined, and the most outlying trees specially mentioned by Christy were visited. The oaks and rowans appear to have grown taller, and the latter seemed quite healthy. The largest of the oaks had an estimated basal diameter of at least six inches. Fifty yards to the north a fourth oak was found with a bole of only one inch in diameter, its crown being flush with the rocks. This was the farthest-out oak seen—fifty yards from any other and over one hundred yards from the main block. A row of five oaks of varying sizes, and probably of varying ages, was found on the rocky east bank of the West Dart about one hundred yards west of the wood margin. One small oak was found growing in the loose dry-stone wall between the wood and the river; it had a basal diameter of about one inch.

All the oaks examined, with one exception (a new seedling of pedunculate oak found on top of a granite slab under the canopy), were growing from interstices completely or nearly completely surrounded by boulders, giving perfect protection against stock. In some cases bushes of gorse, which is abundant in the clatter, completed the protection. There was no evidence of old decaying stumps scattered through the smaller trees away from the main block of larger trees. No birch was seen.

DISCUSSION.

These, then, are the available data. There can be no doubt whatever that the *survival* of the oak, rowan and holly on this very unusual site is solely due to the protection afforded by this peculiar clatter—a protection operative against both animals and climate. The question of the *origin* of the stand still remains to be considered.

It would have been useful if Tansley had given the grounds upon which he bases his statement that the oldest trees have an age of about five hundred years. This point is of such importance that its determination deserves to be supported with detailed evidence. To determine the age merely by counting what appear to be annual rings in the wood is very difficult in the circumstances which hold on a site such as this, with the particular tree species in question. The conditions are almost ideal for the formation of two crops of leaves in a year, with the consequent production of double "annual" rings ;

any estimate of age based exclusively on ring-counts may thus be greatly exaggerated.

Unfortunately, Wentworth-Buller's evidence (1868) is very indefinite. He seems to have set out to determine the age of the wood, but apparently the age of only one tree was ascertained, and that a relatively small one—9 inches by 7 inches in diameter. If this tree had survived to 1932 (the time of Christy's report) it would have been two hundred and twenty-seven years old, having sprung from seed round about A.D. 1705. Some of its congeners may have been, possibly, a hundred and fifty years older, springing from seed sown in A.D. 1555. It might be conjectured that the extreme age of the oldest trees is now about four hundred years, which is a very great age even for an oak in normal growth conditions. Archdeacon Froude's evidence that one tree was at least two hundred and fifty years old in 1838 would place the time of its origin about 1588 or, allowing an extra fifty years for the indistinct rings, about 1540. Today it would thus be about four hundred and ten years old. However, to judge the age of trees growing in these unusual conditions is extremely hazardous; it is difficult enough with old oaks under optimum conditions.

If tradition is to be believed, there was an ancient forest in this district, ascending to as least as high as Crockern Tor. It seems quite probable that the original primeval forest did extend up to and perhaps even beyond the present site of the wood, but it appears almost certain, in view of the locality conditions, that such a forest must have consisted of the usual sessile oak-wood found under similar conditions elsewhere. The remnants of this type of wood are, in fact, described by Tansley from a protected fragment of wood in the valley of the West Okement on the north-west edge of Dartmoor, not many miles away. The altitude is 1000 feet, and the wood consists of *Q. sessiliflora*, *Betula pubescens*, *Sorbus aucuparia*, *Corylus*, and *Salix atrocinerea*. The presence of birch and hazel, absent from Wistman's Wood, is significant.

I would suggest that the primeval forest was dealt with in the usual way—only more expeditiously because of the mines in the vicinity—and completely cleared by human action, except possibly for a clump or two of oaks having some special ritualistic significance. These may have lingered on into historical times, and the stumps mentioned by Martyn may have been the last remains of these oaks. They would, however, have been *sessile* oaks, and it is more probable that they disappeared centuries ago, to be replaced, on clatter areas only, by the present-day pedunculate oaks.

I would further suggest that the first pedunculate oaks in Wistman's Wood sprang from acorns transported by birds—mainly at first by crows—from sources to the west, south-west and south-east ; that they obtained these acorns from pedunculate oaks *planted* somewhere within a radius of from 8 to 10 miles of the areas of clatter ; that they flew to, and perched on the larger granite boulders and that when they began to peck at the acorns, numbers of the nuts fell into the narrow interstices, which are too narrow to permit the birds to retrieve them, even if they had wished. In some cases the acorns would fall through spreading gorse bushes and thus be further protected. Many of these acorns germinated and the young oaks survived because the clatter acts as a perfect protection both against animals and against the force of the wind, against which they have to struggle as soon as they rise above the boulders. It is interesting to note that there was a raven's nesting-place on Great Longford, and that there are still ravens in the district.

In the valley of the River Tavy, which flows some seven miles to the west, the great religious houses of Buckland Abbey and Tavistock Abbey, eleven and seven and a half miles away respectively from Wistman's Wood, could have provided the original planted pedunculate oaks, from which the first Wistman's Wood acorns were taken, at least as early as A.D. 1550 and possibly even earlier. It is even more likely, however, that the woods around Buckfast Abbey, which lies ten miles to the south-west of the wood, in the Dart valley, contributed to supply the birds with the original acorns which gave rise to Wistman's Wood. Such an event could have occurred as early as A.D. 1250. When the Cistercian Order suddenly spread from France to found religious houses all over the more fertile lands of Britain in the twelfth century, one of the earliest foundations was at Ford in Devonshire. This was followed by foundations at Buckfast in A.D. 1137 and at Buckland in 1278. According to Baring-Gould, Buckfast became the richest Cistercian house in the west. It is well known that the Cistercian Order was pre-eminent in the pursuit of agriculture and gardening, and J. S. Fletcher, in *The Cistercians in Yorkshire*, says that "they were constantly making experiments with seeds introduced from other countries. They planted woods and coppices." Moreover, Cîteaux, the continental headquarters of the Order, lies in the region of the Saône, where pedunculate oak predominates. At that time oak was much prized for mast, and it is believed that the taste of pedunculate acorns is less bitter than that of sessile acorns. The species was prized as the domestic or park oak, as distinct from the wild oak.

The planting of only a few pedunculate oaks—even less than twenty—in the vicinity of Buckfast or Buckland Abbey in A.D. 1150 or 1200 would be sufficient to provide a source of seed for rooks or crows. It is amazing how eagerly these birds will strip a pedunculate oak as soon as the acorns reach a certain stage of ripeness—just before they are ready to drop. Moreover, one mature tree of pedunculate oak will bear a very large crop of acorns in a good year, and the species bears more frequently and more heavily than sessile oak. It is not impossible, therefore, that if a fragment of sessile oak-wood still survived at Wistman's Wood, by the period 1250–1300 it contained young oaks grown from pedunculate acorns dropped by birds who had obtained them from the valleys of the Tavey or the Dart. Further, it is not by any means impossible that the wood originated *de novo* avificially at any time between A.D. 1250 and 1450, and so for the age claimed by Tansley for the oldest tree to be correct. In this sense only could it be regarded as a virgin or natural wood, but it would not be an *indigenous* wood in the true sense. I think, however, that the true age of the present trees is much less than five hundred years.

A good case can thus be made to show that possible sources of pedunculate acorns from planted trees were available within easy reach of Wistman's Wood. However, why did the birds always carry pedunculate acorns and seldom sessile acorns? Several reasons can be adduced for this. In the first place, it is probable that lands in the vicinity of the wood had been denuded of original sessile oak-wood for a very long time, and, as is usual, most, if not all, of the new woods artificially established by man would be of pedunculate oak and in the vicinity of the houses on the fertile lowlands. The pedunculate oak is more prolific and produces larger and sweeter acorns than the sessile oak, especially when the former grows on the fertile lands and the latter on the higher and poorer grounds. Again, trees planted in the rich lowlands are usually isolated in parks and hedgerows and thus have large spreading crowns capable of bearing heavier crops. Moreover, the more palatable pedunculate acorns grow on long peduncles, usually in pairs, and are much more easily plucked from the trees than sessile acorns, and carried off by members of the crow family, who do not swallow them whole, but eat them by tearing them to pieces. The acorns are thus apt to drop from the cups during transportation or on the arrival of the birds at a suitable perch or feeding-ground. Sessile acorns, if carried at all, would be carried wholly within the beak. Finally, the birds in their flight with the acorns will tend to move away from habitation into remote

parts to feed on the acorns. This flight is likely to be down wind, and the granite boulders in the West Dart valley provide ideal landing-places, in suitably remote conditions, for birds coming into the valley from the west and south-west.

I suggest, moreover, that this process of avifacial regeneration has been going on slowly for centuries since it first began, and that one reason for the occurrence of the more recently sown young trees on the margins of the older wood is that the birds—not excluding pigeons—can now perch on these older oaks, which form safer places than the smaller boulders, still bare of trees. I suggest further that this wood, far from representing a remnant of a slowly retreating indigenous pedunculate oak-wood, has actually been extending its range in the clatter for many years and that the small scattered outliers, which have no remains of old trees, are new islands produced, not from acorns from the main central mass of the wood, but from acorns brought in by birds from the more distant and prolific oaks in the Dart and Tavey valleys. In any event, one must ask oneself how the acorns from which the outliers have sprung came to jump over the intervening spaces between themselves and the main block—distances of fifty to a hundred yards. The normal method of spread by fall from tall mother-trees is clearly ruled out. If they could be borne a hundred yards, they could be borne for thousands of yards by birds.

Borrer's description of the wood over a century ago does not speak of more than one area of wood, which, he says, forms a narrow stripe, a quarter of a mile at least in length. His estimate is probably only approximate, but if we assume that the stripe was two chains wide, that would give an area of only two acres—the precise area mentioned by Froude in 1838. Christy's estimate of the area in 1922 is four acres—exactly double. We can assume, therefore, that the wood has not been diminishing in extent during the past century.

Taking into account the extremely poor crops of acorns which, from all accounts, the wood appears to produce and the poor quality of these acorns, apart from the vicissitudes to which acorns are always exposed, it seems to me that the seed production of this stunted wood could not by itself maintain the acreage it occupies, far less extend it. It seems much more probable that the unique conditions afforded by the nature of the ground are such as to offer attractive eating-places for birds, suitable seed-beds for accidentally dropped acorns, and ample nourishment and protection for seedlings resulting therefrom, and that the resultant woods are almost all, if not indeed all, derived from acorns transported by birds from distant woods.

One other point supports this view. The associates with the oak in Wistman's Wood are rowan, holly, ivy, honeysuckle and willow, all except the last-named, which has a very light wind-borne seed capable of travelling long distances on the wind, originating from seeds normally borne by birds. There is no birch or hazel in the wood, neither of whose seeds are normally carried by birds, although that of the former will fly for considerable distances. On the other hand, both birch and hazel occur in the remains of indigenous sessile oak-wood in the West Okement valley.

The sessile oak is a hardier tree than the pedunculate oak, especially under the conditions of site and soil which prevail on Dartmoor. It may be presumed, therefore, that the original indigenous sessile oak-wood, which formerly occupied the site of Wistman's Wood, was better able to withstand the exposure there than the present pedunculate trees, and that these original trees, sheltered as they must have been by masses of larger trees on the better ground below them, must have attained to a more satisfactory height than the stunted pedunculate specimens, and that they may have been sizable and usable enough to justify their complete clearance at some early date. Such an occurrence might explain why they were not succeeded by a new generation of sessile trees, especially as the chances of such a clearance happening in a good seed-year would be very small indeed at this altitude. Regeneration by stool-shoots on this site would also be very difficult.

Similar examples of avificial woods, which have arisen because conditions are such as to enhance very considerably the chances of seeding and survival of bird-borne acorns, have been recorded from many localities, but they are less spectacular because the numbers involved are fewer, or because the sites where they occur are less unusual and less striking. However, one interesting example which comes to mind is in Menstrie Glen in the Ochils, where there yet remain three very old and gnarled sessile oaks, while numerous younger pedunculate oaks have sprung up in the fissured rocks around the wood in which they stand, protected from sheep and rabbits, just as in Wistman's Wood.

It is doubtful whether the pedunculate oaks in Wistman's Wood could maintain themselves in that habitat, if they were not constantly reinforced by fresh stock from the outside. While its claim to be called a virgin wood may remain unchallenged, it cannot, I believe, be regarded as a natural wood of an indigenous species in the accepted sense.

NOTES ON SOME UNCOMMON ALGAE FROM LOCHS IN THE TUMMEL-GARRY CATCHMENT AREA.

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(Read by title, 14th January 1954.)

In connection with work in progress at the Brown Trout Research Laboratory, Pitlochry, several lochs in the Tummel-Garry Catchment Area have been intensively studied. These are Lochs Choin and Cruinn (27 688679), Kinardochy (27 775550), Moraig (27/908666) and Lochan an Daim (27 718574).^{*} From these a number of interesting species and varieties of algae have been identified with certainty and are therefore recorded here. Several are new records for Britain. The affinities of some others are obscure and require further study before being placed on record.

CHLOROPHYCEAE.

1. *CHLAMYDOMONAS CINGULATA* Pascher, var. *SELIGERIENSIS* Korschikoff. Pascher (1927), pp. 271 3, fig. 230c. (text-fig. 1, 1.)

An uni-algal culture of this *Chlamydomonas* was found, in May 1953, in a small rock pool on an island in Loch Kinardochy on which two families of gulls were nesting. The cells, which were mostly 18–20 μ l., 16 μ br., agree closely with the description given in Pascher (1927). A new British record.

2. *ELAKATOTHRIX GELATINOSA* Wille.

Frequent at times in the plankton of Lochs Cruinn and Kinardochy. Cells mostly 14–16 μ l., 2.5–3 μ br.

3. *MICRACTINIUM PUSILLUM* Fresen., forma *QUADRISETA* (Lemm.). (text-fig. 1, 2.)

Occasional in Loch Moraig. Previously recorded only from the plankton of Lough Beg, Ireland. Cells 8 μ diam., with "chlorococcoid" cell structure, and bearing four hollow bristles, each 16 μ l.

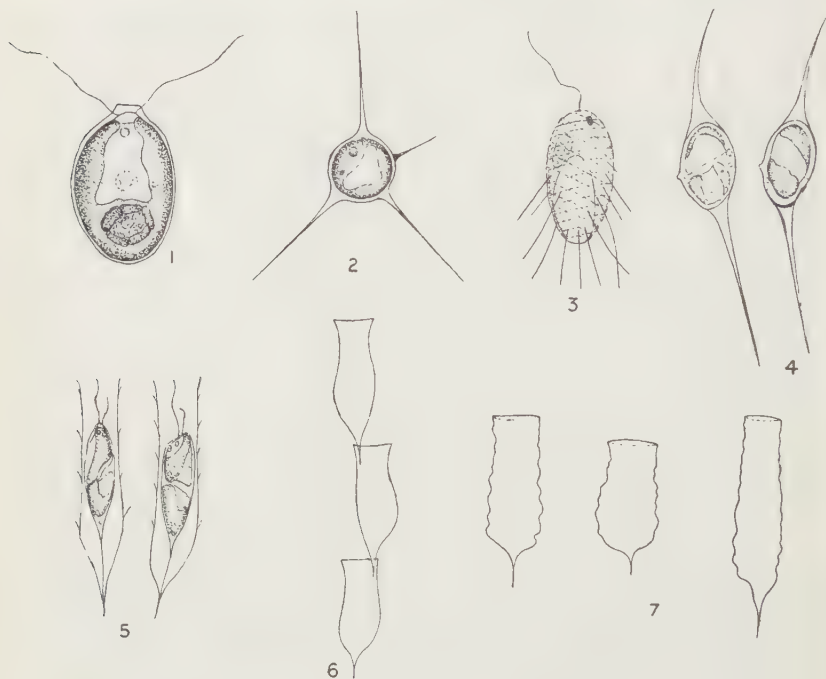
* The figures in brackets are normal National Grid references from the 1-inch Ordnance Survey of Scotland (1946), sheet 27.

4. *OOCYSTIS PANDURIFORMIS* West and West.

Common in Loch Cruinn.

5. *MONOSTROMA MEMBRANACEUM* W. and G. S. West.

Several well-developed plants taken in grab samples from the bottom of Loch Kinardochy at depths of five to fifteen feet; these



TEXT-FIG. 1.

1. *CHLAMYDOMONAS CINGULATA* Pascher, var. *SELIGERIENSIS* Korschikoff. ($\times 500$.)
2. *MICRACTINIUM PUSILLUM* Fresen., forma *QUADRISETA* (Lemm.). ($\times 500$.)
3. *MALLOMONAS PALLIDA* Conrad. ($\times 375$.)
4. *DICERAS CHODATI* Reverdin. ($\times 500$.)
5. *HYALOBRYON MUCICOLA* Pascher. ($\times 500$.)
6. *DINOBRYON SOCIALE* var. *AMERICANUM* (Brunn.) Bachm. ($\times 250$.)
7. *DINOBRYON CRENULATUM*. ($\times 375$.)

were brought to the author's notice by Mr. W. R. Munro. There are only two previous British records of this alga.

6. *CHAETONEMA IRREGULARE* Nowak.

Common at times on submerged glass slides in Lochs Kinardochy and Choin. Previously recorded only from W. Yorkshire (West, 1912).

7. *BOTRYOCOCCUS SUDETICUS* Lemm.

Rare with *Botryococcus braunii* and *Stichogloea doederleinii* in Loch Choin. Cells $8\ \mu$ l., $6\ \mu$ br.

CHRY SOPHYCEAE.

8. *STICHOGLOEA DOEDERLEINII* (Schmidle) Wille.

Common at times in Lochs Kinardochy and Choin between May and October with *Botryococcus braunii*: maximum abundance in August. Although there is only one previous British record of this alga, it is probably common in summer in many Scottish lochs.

9. *CHRYSOCHAETE BRITANNICA* (Godward) Rosenberg. Rosenberg (1941).

Common on submerged slides in Loch Kinardochy, less abundant in Loch Choin. When this alga was first discovered by Godward (1933) in two pools near Epping Forest, she believed it to be a rare species. However, since then it has been found in Lake Windermere (Godward, 1937), in ponds near Richmond, Surrey (Lund, 1942), in filter beds in Northumberland (Brook—in the press) and now in these two Scottish lochs, which suggests that it has a wide and fairly general distribution throughout Britain.

10. *MALLOMONAS PALLIDA* Conrad. Huber-Pest. (1941), p. 99. Abb. 121. (text-fig. 1, 3.)

Occasional in Loch Moraig in March and early April. Cells mostly $15\text{--}16\ \mu$ l., $10\ \mu$ br., ellipsoidal with rhomboidal scales; spines only in posterior half of cell. One small, pale, disc-shaped chromatophore. Not previously recorded for Britain.

11. *DICERAS CHODATI* Reverdin. Huber-Pest. (1941), p. 209. Abb. 279. (text-fig. 1, 4.)

Quite common during early summer (May–June) in Lochs Cruinn, Kinardochy and Moraig. Cells usually $10\text{--}12\ \mu$ l., $6\text{--}8\ \mu$ br., with bristles of unequal length; mostly 15 and $25\ \mu$ l. No previous record for Britain.

12. *HYALOBRYON MUCICOLA* Pascher. (text-fig. 1, 5.)

Common in groups of $40\text{--}50$ cells on submerged glass slides on an inorganic shore in Loch Kinardochy during May. This alga has been previously recorded from the British Isles only from Loch Earn.

Cells $16\ \mu$ l., $4\ \mu$ br., attached to envelopes by fine stalks $15\text{--}20\ \mu$ l. Envelopes up to $8\ \mu$ br. and $40\text{--}50\ \mu$ l.

13. *DINOBYRON BARVARICUM* Imhof, var. *MEDIUM* (Lemm.) Kreiger. Huber-Pest. (1951), p. 225, fig. 297.

With *D. barvaricum* in Loch Kinardochy. Envelope $56\ \mu$ l., $7\ \mu$ br. A new British record.

14. *D. SOCIALE* Ehr. var. *STIPITATUM* (Stein) Lemm. Huber-Pest. (1941), p. 226, fig. 299.

Occasional with the type species in Lochan an Daim during a period of great abundance in April 1953. Bachmann (1907) records this alga under the name *D. stipitatum* var. *elongatum* Imhof, from Lochs Lochy and Oich.

15. *D. SOCIALE* var. *AMERICANUM* (Brunn.) Bachm. Huber-Pest. (1941), p. 226, fig. 300. (text-fig. 1, 6.)

Common in Loch Moraig between March and early May. Occasional in Lochan an Daim in April. Envelopes measuring $30\text{--}40\ \mu$ l., $9\text{--}10\ \mu$ br. In Loch Moraig numerous cysts, $9\ \mu$ in diameter, were formed throughout April.

16. *D. DIVERGENS* Imhof. var. *ANGULATUM* (Seligo) Brunnth. Huber-Pest. (1941), p. 229, fig. 303.

Rare, with the type species and *D. cylindricum* in Loch Kinardochy during autumn, winter and spring. Envelopes $40\text{--}50\ \mu$ l., $10\ \mu$ br.

17. *D. SUECICUM* Lemm. Huber-Pest. (1941), p. 216, fig. 288.

Very rare in Loch Kinardochy in January and February. Delicate envelope, $20\ \mu$ l., $4\ \mu$ br., with characteristic spiral sculpturing on wall. Lund (1952) has recently found the var. *longispinum* of this species in the Lake District.

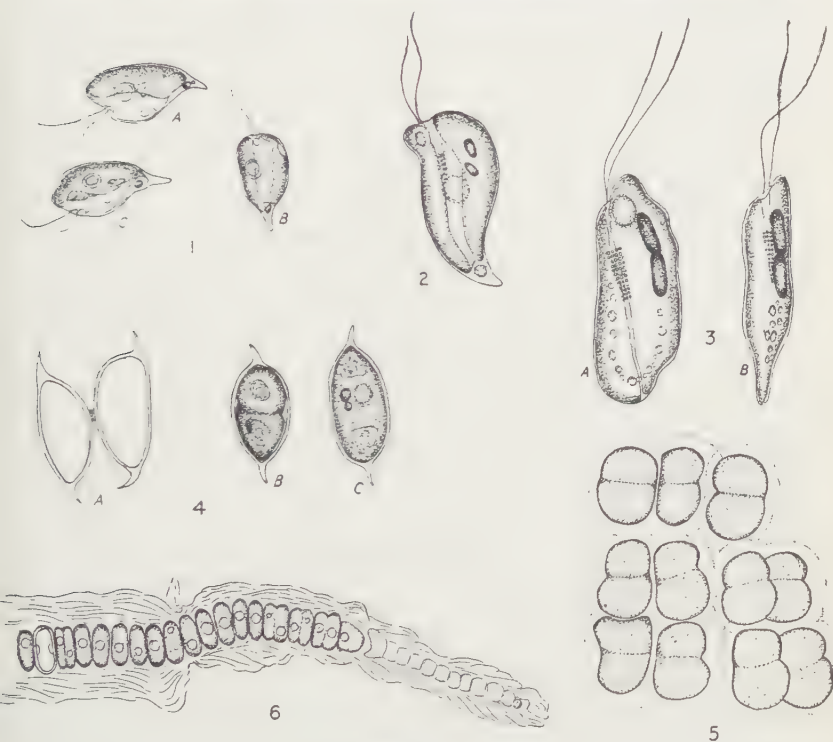
18. *D. CRENULATUM*. W. and G. S. West, *Naturalist*, Lond., 1909, p. 325, and figs. 7c and 7d. (text-fig. 1, 7.)

Common in December and January, and again in April and early May, in Loch Kinardochy. Always solitary. Total length of envelope varying from 24 to $36\ \mu$. Breadth at base $6.5\text{--}9\ \mu$ (mostly $8\ \mu$), narrowing slightly to $6\text{--}7.5\ \mu$ below lip at top of the envelope. The completely crenulate wall is a very distinctive feature.

CRYPTOPHYCEAE.

19. *CHROOMONAS ACUTA* Utermohl. Huber-Pest. (1950), p. 33, fig. 19. (text-fig. 2, 1.)

Abundant in Loch Kinardochy from January to March. Maximum of 4000 cells per ml. after disappearance of ice-cover on 21st



TEXT-FIG. 2.

1. *CHROOMONAS ACUTA* Utermohl.
2. *CRYPTOMONAS EROSA* Ehr. var. *REFLEXA* Marsson. ($\times 500$.)
3. *CRYPTOMONAS PLATYURIS* Skuja. ($\times 375$.)
4. *CYSTODINIUM BICORNE* (Wol.) Huber-Pest. ($\times 375$.)
5. *MERISMOPEdia MAIOR* (Smith) Geitler. ($\times 500$.)
6. *SCYTONEMA CRUSTACEUM* Agardh. ($\times 250$.)

February. Also present during the same period in Loch Tummel. Cells spindle-shaped ($7-10 \times 4-5.5 \mu$), with a broad anterior end becoming narrow towards posterior end and ending in a characteristically curved, projecting tip, which persists even when the cells become mis-shapen when killed with formalin (see fig. 2, 1C). Gullet short. Flagella slightly smaller than length of cell. Pyrenoid

usually quite distinct, centrally placed on the dorsal side of the cell. Single chromatophore, olive green in colour. Movements rapid and usually erratic. A new British record.

20. *CRYPTOMONAS EROSA* Ehr. var. *REFLEXA* Marsson. Huber-Pest. (1950), p. 53, fig. 29. (text-fig. 2, 2.)

Very rare in Loch Moraig in spring. Cells $21\ \mu$ l., $11\ \mu$ br. A new British record. The somewhat similar *Cryptomonas marssonii* Skuja (Huber-Pest. (1950), p. 58, fig. 39) has also been found in January in Loch Leven (Kinross). Cells $24\text{--}39\ \mu$ l., $12\ \mu$ br. This is also a new record for Britain.

21. *C. PLATYURIS* Skuja. Huber-Pest. (1950), p. 57, fig. 34. (text-fig. 2, 3.)

A few fine specimens amongst attached growths of algae on glass slides from Loch Cruinn in May. Cells $40\ \mu$ l., $16\ \mu$ br., $10\ \mu$ thick.

The most distinctive features of this species are the more or less wedge-shaped side view (see 2, 3B), the prominent trichocysts in the narrow gullet and the two large, ellipsoidal metachromatic bodies (Skuja's "volutinartige Körper") situated on the dorsal side in the anterior half of each cell. In the Loch Cruinn specimens these were considerably larger than those illustrated by Skuja (1948, Taf. 37, figs. 37–38). A new British record.

DINOPHYCEAE.

22. *CYSTODINIUM BICORNE* (Wol.) Huber-Pest. Huber-Pest. (1950), p. 299, fig. 293A. (text-fig. 2, 4.)

Frequent on submerged slides in Loch Cruinn. Cells $25\text{--}30\ \mu$ l., $12\text{--}16\ \mu$ br., with spines $35\text{--}40\ \mu$ l., spines usually $5\text{--}7\ \mu$ l., frequently curved. Some cells symmetrical though mostly asymmetrical, containing numerous brown chromatophores. No sign of furrows in vegetative cells, but these appear as the protoplast contracts before division (see 4B). Two large vacuoles at each end of the cell in which there is a constant, and very rapid movement of fine granular material. A new British record.

CYANOPHYCEAE.

23. *MERISMOPEDIA MAIOR* (Smith) Geitler. Geitler (1932), p. 265, fig. 130. (text-fig. 2, 5.)

Rare in plankton of Loch Choin. Small colonies, 8–16 cells. Cells $8\text{--}10\ \mu$, vivid blue-green in colour with homogeneous contents. Cells

in groups of 4, each group being surrounded by a distinct mucilage envelope and thus clearly separated from one another, a characteristic which seems to distinguish this species from *M. elegans* A. Br. Geitler (1932) seems to question Smith's (1920) statement about the absence of a mucilage envelope ("ohne (*immer*!) Spezialhüllen") which is unquestionably present in the Loch Choin specimens. Though not previously recorded for Britain, Lund (private communication) states that he has seen this alga in Lake Windermere.

24. *SCYTONEMA CRUSTACEUM* Agardh. Geitler (1932), p. 782, figs. 503-4. (text-fig. 2, 6.)

Common on stones with *Tolypothrix tenuis* in 1-2 feet of water in Loch Kinardochy. Cells mostly $10\ \mu$ br., $4-8\ \mu$ l., with marked constrictions between cells. Trichomes surrounded by stout, irregular lamellar mucilage sheath varying in breadth from 20 to $30\ \mu$. Heterocysts slightly broader than cells of trichome ($11\ \mu$ br., $7\ \mu$ l.).

HETEROKONTAE.

25. *HETEROCOCCUS VIRIDIS* Chodat. Pascher (1925), p. 113, fig. 92.

Frequent with *Chrysochaete britannica* in Loch Kinardochy. Small flat plates of cells, usually 4-12 per plate, outer margins of cells rounded, inner margins contiguous with other cells and distinctly angular. Cell walls thick, each cell $8-10\ \mu$ br., with several brown, lobed chromatophores.

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A FIRST LIST OF THE FUNGI OF ZETLAND (SHETLAND).

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(Read by title, 14th January 1954.)

There is a considerable amount of published information about the fungi of the Faeroes but we do not know of any published list of Shetland fungi. From records of plant pathogenic species accumulated during the past nine years, and a number of collections of higher fungi and saprophytes made during August and September 1952, we have compiled a list which may form a basis for preliminary comparisons with the fungus floras of other North Atlantic islands.

The Shetland Islands lie between latitudes $60^{\circ} 51' 45''$ N. (a stack north of Unst) and $59^{\circ} 30' 30''$ N. (the south end of Fair Isle) and between longitudes $0^{\circ} 40' 20''$ W. (Bound Skerry) and $2^{\circ} 7'$ W. (the west side of Foula). Sumburgh Head, the most southerly point on the main island, is 24 miles north-north-east of Fair Isle, 50 miles north-east of North Ronaldshay, in Orkney, and 170 miles north of Buchan Ness, in Aberdeenshire, on the Scottish mainland. The Out Skerries, a group of islands on the east side, are 204 miles west of Bergen. The total land area of Shetland is 551.4 square miles.

Human invasion of Shetland has gone on over at least three thousand years from south, south-east and east, and there have been many opportunities during this time for fungi to be brought in by man and his domestic animals. Comparisons of the fungus flora of Shetland with that of the mainland of Scotland on the one hand, and of the Faeroes and Iceland on the other, are therefore of little value as contributions to the study of the natural distribution of fungi. The interest of the present list must lie rather in demonstrating which of the species accidentally introduced into the islands have succeeded in establishing themselves in spite of the somewhat rigorous climatic and edaphic conditions.

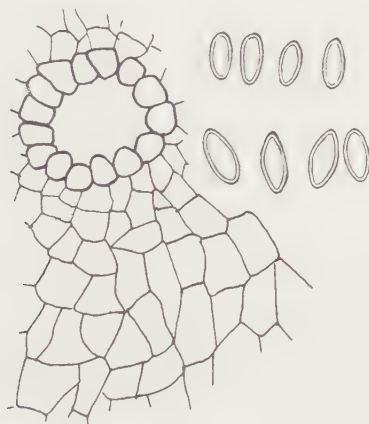
From the comparative standpoint, the most useful records are

probably these of the forty-six agarics. These were almost all obtained on the northernmost islands, Unst and Yell, which are now completely devoid of native trees or shrubs, though branches of birch occur in the peat. In a few sheltered places there is a scanty growth of *Salix repens*, but none of the agarics collected was growing in association with this plant. One species, *Coprinus micaceus*, was found in the only plantation of trees on Unst, a small walled enclosure at Baltasound; the remaining species of *Coprinus*, *Anellaria semi-orata* and, to some extent, *Stropharia semiglobata* are coprophilous. The other forty species are plants of open moor, bog, or the somewhat better-drained patches of pasture and roadside grass. Similar habitats in the small isles of Inverness, Ardnamurchan and West Ross have yielded in addition *Agaricus campestris* (F), *A. langei*, *Marasmius androsaceus* (F), *Omphalia flava* (F), *Entoloma ameides* (F), *E. jubatum*, *Leptonia placida*, *Eccilia cancrina*, *Pholiota praecox* var. *paludosa* (F), *Inocybe lacera* var. *subsquarrosa* (F), *Naucoria myosotis* (F), *Galerina tibicystis*, *Hygrophorus cinereus*, *H. russocoriaceus* (F), *H. virgineus* (F) and *H. laetus* (F). All those marked (F) are already known from the Faeroes and may confidently be expected to be found in Shetland. Adding these to the present list, we obtain a list of fifty-five species which one may regard as the characteristic agaric flora of the rain-sodden treeless moorlands and hill pastures of our Atlantic coasts and islands.

Within this flora a number of ecological groupings is discernible. Most obvious is the well-known assemblage of species confined to *Sphagnum*, viz. *Galerina paludosa*, *G. sphagnorum*, *G. tibicystis*, *Omphalia oniscus*, *O. pseudoandrosacea* sensu Möller, with a few less rigidly restricted species that occur also on wet moors away from *Sphagnum*: *Psilocybe uda*, *P. elongata* and *Hygrophorus miniatus*. Other species of swampy ground are *Naucoria myosotis* and *Pholiota praecox* var. *paludosa*.

Marasmius androsaceus in moorland habitats seems to be intimately associated with *Calluna*, though the assertion that it is parasitic on that plant must be regarded as not proven. *Omphalia brownii*, *Galerina hypnorum* and *G. rubiginosa* are associated with mosses of grassland. *Mycena sanguinolenta* and *M. alcalina* var. *chlorinella* seem to be restricted in Shetland to *Juncus* tussocks. *Omphalia umbellifera*, *Galerina sahleri* and sometimes *G. hypnorum* and *Psilocybe subericaea* occur on bare peat. The remaining species, especially the *Hygrophori*, seem to favour the better-drained soils where grasses prevail over carices, as along roadsides and on sandy flats at the head of bays.

The records of *Leptonia linkii* and *L. andrianæ* refer to those fungi as interpreted by Möller and add two more species to the long list of British agarics. *Entyloma holci* has also not been reported from the British Isles before. This is somewhat surprising as Dr. Jørstad tells us it is common in Norway. *Phoma stagonosporoides* has apparently not been collected since the type gathering was made by Trail on a dead leaf of *Phragmites communis* at Loch Achray, Perthshire (15 IX 1888). The Yell collection was on dead tips of living *Molinia*



TEXT-FIG. 1.—*Phoma stagonosporoides* Trail.

Ostiole with part of pycnidial wall in surface view and spores, $\times 660$. Upper row of spores from Trail's slide of the type, lower row fresh from *Molinia*, Yell. The slight difference in spore size is due to the shrinkage of the former, for Trail's label reads "Spores $10-12 \times 3-3\frac{1}{2}$."

on the cliff at West Sandwick, but there was no indication that the fungus was a parasite. In spite of the difference in host genus, comparison with a slide of the type collection in Trail's herbarium leaves us confident of the substantial accuracy of the determination. As the only published description is rather scanty, we figure this interesting species in fig. 1. *Cercospora pantoleuca* (Sacc.) Sacc. does not appear under this name in the list of British Hyphomycetes, but possibly it may represent only a state of the well-known *Ramularia plantaginea* Sacc. & Berl. The Unst collection yields spores $50-60 \times 3-3.5 \mu$. We have retained the familiar name *Ascochyta graminicola* Sacc., but according to Sprague this is a synonym of *A. sorghi* Sacc., published a year earlier, and Müller has recently claimed that the perfect state of the fungus is *Didymella exitialis* (Morini) Müller.

The range of crops cultivated is small and there are not many gardens. The oat species *Avena strigosa* Schreb. is still grown on the arable ground of the crofts and on the calcareous sandy soils which are a feature of the north and west coasts of Scotland and of the out-lying islands. *A. strigosa* has the merit of producing a crop on soils deficient in manganese. The shell-sand soils provide conditions favourable for smut diseases in this oat and in bere, a form of barley commonly grown in some districts. Smuts are less frequent in *A. strigosa* where this species continues to be cultivated on the wetter soils, but they are still found in *A. sativa* L., in the older varieties and old stocks of seed.

In Shetland, as in other crofting areas, stalk break, caused by *Sclerotinia sclerotiorum*, is occasionally troublesome in potato crops. The climate of the islands favours blight, which has been known there since about 1840* and in some seasons is very destructive. The bulk of the diseases on cereals and potatoes have doubtless been introduced on seed and tubers from Scotland. A native selection of cabbage which is widely grown is highly resistant to club root in the islands, but not necessarily in other areas.

LIST OF SPECIES RECORDED FROM ZETLAND

HOMOBASIDEAE.

- AGARICUS BERNARDII (Quél.) Sacc. Unst.
 ANELLARIA SEMI-OVATA (Sow ex Fr.) Pearson & Dennis. Unst, Yell, Burra (Mr. Laurenson). (F) (I).†
 BOVISTA NIGRESCENS Pers. Unst. (I).
 B. PLUMBEA Pers. Unst, Burra (Mr. Laurenson). (F) (I).
 CLAVARIA INAEQUALIS Fr. Yell. (I).
 COLLYBIA DRYOPHILA (Bull. ex Fr.) Quél. Unst, Yell.
 CONOCYBE TENERA (Schaeff. ex Fr.) Fayod. Lerwick. (F) (I).
 COPRINUS COMATUS (Müll. ex Fr.) S. F. Gray. Unst.
 C. EPHEMERUS (Bull. ex Fr.) Fr. On pony dung. Yell. (F) (I).
 C. MICACEUS (Bull. ex Fr.) Fr. *Acer* plantation, Unst.
 C. PATOUILLARDII (Quél.) Pat. On pony dung. Yell. (F) (I, as *C. cordisporus* Gibbs).
 CORTICIUM SAMBUCI (Pers. ex Fr.) Fr. On planted *Sambucus*. Unst.
 C. SOLANI Bourd. & Galz. *Rhizoctonia* state on *Solanum tuberosum*. Dunrossness, Lerwick.
 CORTINARIUS CINNAMOMEUS (L. ex Fr.) Fr. In pasture. Yell. (I).

* "The potato disease was unknown in Shetland until some six or seven years ago, since which time its effects have been generally and pretty severely felt." Letter dated 13th April, 1846, from Mr. Andrew Duncan of Tow, printed as No. 103 in Appendix to Highland and Agricultural Society's Report on *The Disease of the Potato Crop in Scotland, 1845* (1846).

† (F) and (I) indicate recorded from Faeroes and Iceland respectively.

- GALERINA HYPNORUM (Schrank ex Fr.) Kühner. Yell. (F) (I).
 G. PALUDOSA (Fr.) Kühner. In *Sphagnum*. Unst, Yell.
 G. RUBIGINOSA (Pers. ex Fr.) Kühner. In *Polytrichum*. Yell.
 G. SPHAGNORUM (Pers. ex Fr.) Kühner. In *Sphagnum*. Yell.
 HYGROPHORUS CHLOROPHANUS Fr. Yell. (F).
 H. COCCINEUS (Schaeff. ex Fr.) Fr. Unst, Yell.
 H. CONICUS (Scop. ex Fr.) Fr. Unst, Yell. (F) (I).
 H. FORNICATUS Fr. Yell. (F, as var. *clivalis*.)
 H. IRRIGATUS (Pers. ex Fr.) Fr., ? = *H. unguinosus* Fr. Yell. (F).
 H. MINIATUS (Scop. ex Fr.) Fr. In *Sphagnum* and *Polytrichum*. Yell. (F) (I).
 H. NIGRESCENS Quél. Unst. (F).
 H. NIVEUS (Scop. ex Fr.) Fr. Yell. (F) (I).
 H. PRATENSIS (Pers. ex Fr.) Fr. Unst. (F) (I).
 H. PSITTACINUS (Schaeff. ex Fr.) Fr. Yell. (F).
 H. RICKENI Maire. Unst. (F).
 LEPIOTA AMIANTHINA (Scop. ex Fr.) Karst. Unst, Yell.
 LEPTONIA ANDRIANAE Bres. sensu Möller. Yell. (F).
 L. INTERMEDIA Möller. Yell. (F.) Somewhat doubtfully distinct from
N. staurospora Bres.
 L. LINKII (Fr.) Gillet sensu Möller. Yell. (F).
 MYCENA ALCALINA (Fr.) Quél. var. *chlorinella* Lange. Among *Juncus* in ditch.
 Yell.
 M. SANGUINOLENTA (Alb. & Schw. ex Fr.) Quél. In *Juncus* tussocks. Unst,
 Yell.
 NOLANEA STAUROSPORA Bres. Unst, Yell. (F).
 OMPHALIA BROWNII (Berk. & Br.) Favre. Yell.
 O. ONISCUS (Fr.) Gillet sensu Favre. In *Sphagnum*. Yell. (I).
 O. PSEUDOANDROSACEA (Bull. ex Fr.) Gillet sensu Möller. In *Sphagnum*.
 Unst. (F).

Though the Zetland collections referred to here agree with those described by Möller from Faeroe under the above name, *Agaricus pseudoandrosaceus* Bull. ex Fr. is usually interpreted as a synonym of *A. umbelliferus* L. ex Fr.

- O. ROSELLA Lange. Unst. (F).
 O. UMBELLIFERA (L. ex Fr.) Quél. Yell. (F) (I).
 f. bispora Möller. Unst. (F).
 f. albida Lange. Unst, Yell.
 PANAEOLUS ACUMINATUS (Schaeff. ex Fr.) Quél. Unst. (F).
 PSATHYRELLA FIBRILLOSA (Pers. ex Fr.) Pearson & Dennis. Yell. (F as
Psathyra.)
 PSILOCYBE ELONGATA (Pers. ex Fr.) Lange. In *Sphagnum*. Yell. (I).
 P. FOENESECH (Pers. ex Fr.) Quél. Unst, Yell.
 P. PHYSALOIDES (Bull. ex Fr.) Quél. Yell. (F) (I).
 P. SEMILANCEATA (Fr.) Quél. Unst, Yell. (F as var. *caerulescens*.)
 P. SUBERICAEA (Fr.) Sacc. Yell.
 P. UDA (Pers. ex Fr.) Gillet. Yell.
 STROPHARIA SEMIGLOBATA (Batsch ex Fr.) Quél. Unst, Yell. (F) (I).
 TRICHOLOMA PANAEOLUM (Fr.) Quél. Unst. (I).

HETEROBASIDEAE.

- DACRYMYCES DELIQUESCENTS (Bull. ex Mérat) Duby. On *Sambucus*. Unst.
 (F) (I).
 ENTYLOMA HOLCI Liro. On *Holcus lanatus*. Yell.

- MELAMPSORA LINI (Ehrenb.) Lév. Not seen by us, but recorded by Druce on *Linum catharticum*. (F) (I).
- PUCCINIA ACETOSAE Koern. II on *Rumex acetosa*. Unst. (F) (I).
- P. CALTHICOLA Schroet. On *Caltha palustris*. Unst. (F).
- P. CARICINA DC. II on *Carex binervis*. Unst. (F) (I).
- P. CIRSII Lasch. On *Cnicus palustris*. Lerwick.
- P. CIRSII-LANCEOLATI Schroet. On *Cnicus lanceolatus*. Unst.
- P. HIERACTI Mart. II on *Leontodon autumnalis*. Unst. (F as *P. leontodontis*.) (I).
- P. HOLCINA Erikss. II on *Holcus lanatus*. Unst. (F).
- P. LYCHNIDEARUM Link. On *Lychnis dioica*. Yell.
- P. POAE-NEMORALIS Otth. II on *Anthoxanthum odoratum*. Unst. (F as *P. poae-sudeticae*.) (I).
- P. VIOLAE DC. II & III on *Viola riviniana*. Unst. (F) (I).
- PUCCINIASTRUM VACCINII (Wint.) Jørstad. On *Vaccinium uliginosum*. Unst. (F as *P. myrtilli*.)
- THECOPOSORA GALII de Toni. II on *Galium saxatile*. Yell.
- TILLETIA DECIPIENS (Pers.) Koern. On *Agrostis*. Recorded by Druce inferentially as he lists *A. capillaris* var. *pumila*, now known to be a diseased state due to infection with this smut.
- UROCYSTIS ANEMONES (Pers.) Wint. On *Ranunculus acris*. Unst. (F as *Tubercinia ranunculi*.)
- UROMYCES FABAE de By. II & III on *Vicia cracca*. Yell.
- U. NERVIPHILUS (Gron.) Hotson. On *Trifolium repens*. Unst. (F as *U. flectens*) (I).
- U. POAE Rabh. II & III on *Poa pratensis*. Unst. (I).
- U. TRIFOLII Lev. II on *Trifolium pratense*. Unst.
- USTILAGO AVENAE (Pers.) Jens. On *Avena sativa*. Lerwick, Delting, Northmaven. (F).
- On *A. strigosa*. Skerries, Foula.
- U. HORDEI (Pers.) Lagerh. On *Avena strigosa*. Skerries, Foula.
- On *A. sativa*. Tingwall.
- On *Hordeum sativum*. Dunrossness, Northmaven, Foula. (I).
- U. NUDA (Jens.) Rostr. On *H. sativum*. Dunrossness, Northmaven. (F).
- U. LONGISSIMA (Sow. ex Schlecht.) Meyen. On *Glyceria fluitans*. Unst. (F).
- U. VIOLACEA (Pers.) Fuckel. On *Lychnis flosculi*. Unst. (F) (I).

DISCOMYCETAE.

- ASCOBOLUS GLABER Pers. ex Fr. On sheep dung. Yell. (I).
- ASCOPHANUS GLAUCELLUS Rehm. On cow dung. Unst.
- DASYSCYPHA APALA (Berk. & Br.) Dennis. On *Juncus effusus*. Yell.
- GEOGLOSSUM FALLAX Dur. Unst.
- LASIOBOLUS EQUINUS (Müll.) Karst. On sheep dung. Yell. (I).
- MOLLISIA CINEREA (Batsch ex Fr.) Karst. On *Calluna*. Unst. (I).
- NAEVIA PUSILLA (Lib.) Rehm. On *Juncus effusus*. Yell. (I).
- PEZIZA RUTILANS Fr. sensu Cooke. In *Polytrichum*. Yell.
- PHAEANGELLA EMPETRI (Phill.) Boud. On *Empetrum*. Unst.
- PHIALEA TEMULENTA Prill. & Delacr. On *Lolium perenne*. Dunrossness.
- PSEUDopeziza TRIFOLII (Biv.-Bern.) Fuckel. On *Trifolium pratense*. Mainland, Unst.
- RHYTISMA SALICINUM Fr. On *Salix repens*. Unst. (I).
- SCLEROTINIA SCLEROTIORUM (Lib.) de By. On *Solanum tuberosum*. Dunrossness, Bressay.

PYRENOAMYCETEEAE.

- CLAVICEPS PURPUREA (Fr.) Tul. On *Nardus stricta*. Yell, Dunrossness. (I).
 DIDYMELLA IRIDIS (Desm.) von Höhn. On *Iris pseudacorus*. Yell.
 ENDODOTHELLA JUNCII (Fr.) Theiss. & Syd. On *Juncus effusus*. Yell.
 EPICHLÖE TYPHINA (Fr.) Tul. On *Agrostis stolonifera*. Unst, Dunrossness.
 ERYSIPIHE GRAMINIS DC. On cereals and various grasses. Mainland.
 LEPTOSPHAERIA NARDI (Fr.) Ces. & de Not. On *Nardus stricta*. Yell. (Det.
 Dr. A. von Arx.)
 LOPHODERMIIUM CULMIGENUM (Fr.) Karst. f. *festucae* Roum. On *Festuca ovina*
 f. *vivipara*. Unst.
 NECTRIA CINNABARINA (Tode ex Fr.) Fr. *Tubercularia* state on *Ribes rubrum*.
 Unst. (I).
 OPHIOBOLUS GRAMINIS Sacc. var. *avenae* Turner. On *Avena sativa*. Unst,
 Dunrossness.
 O. RUBELLUS (Pers.) Sacc. On *Angelica sylvestris*. Yell.
 PHYLLACHORA GRAMINIS (Pers. ex Fr.) Fuckel. On *Dactylis glomerata*.
 Dunrossness.
 PLEOSPORA HERBARUM (Pers. ex Fr.) Rabh. On *Agrostis stolonifera* and
Cerastium arcticum, Unst; on *Plantago maritima*, Yell. (I).
 PLOWRIGHTIA RIBESIA (Pers. ex Fr.) Sacc. On *Ribes rubrum*. Unst. (I).
 PYRENOPHORA AVENAE Ito & Kuribay. *Helminthosporium* state on *Avena*
sativa, Mainland, and *A. strigosa*, Foula.
 SPORORMIA INTERMEDIA Auersw. On sheep dung. Yell. (I).
 TRICHOSPHAERIA MYRIOCARPA (Fr.) Petrak & Sydow. On *Calluna vulgaris*.
 Unst.
 VENTURIA INAEQUALIS (Cke.) Aderh. *Fusicladium* state on cultivated apple.
 Unst.
 V. MYRTILLI Cke. On *Vaccinium uliginosum*. Unst. (I).

PHYCOMYCETAE.

- CYSTOPUS LEPIGONI de By. On *Spergularia*. Unst.
 PERONOSPORA HONCKENYAE (Syd.) Syd. On *Honckenia peplodes*. Yell.
 P. RANUNCULI Gäum. On *Ranunculus flammula*. Yell.
 PHYTOPHTHORA INFESTANS (Mont.) de By. On *Solanum tuberosum*. Unst,
 Mainland, Skerries, Fair Isle, Foula.
 PILOBOLUS KLEINII van Tiegh. On cow dung. Unst. (I).
 PLASMODIOPHORA BRASSICAE Woron. On Cabbage, Turnip and Swede.
 Mainland, Fair Isle, Foula.
 PLASMOPARA Densa (Rab.) Schroet. On *Euphrasia* spp. Unst, Yell.
 SPONGOSPORA SUBTERRANEA (Wallr.) Lagerh. On *Solanum tuberosum*. Unst,
 Mainland.

COELOMYCETEEAE.

- ASCOCHYTA CHENOPODII Rostr. On *Chenopodium rubrum*. Unst.
 A. GRAMINICOLA Sacc. On *Poa pratensis* and *Cynosurus cristatus*. Unst.
 A. VULGARIS Kab. & Bub. var. *symphoricarpi* Grove. On *Symphoricarpus*
racemosus. Unst.
 DILOPHOSPORA ALOPECURI (Fr.) Fr. On *Holcus lanatus*. Unst.,
 PHOMA COMPLANATA (Tode) Desm. On *Angelica sylvestris*. Yell. (I).
 P. DEUSTA Fckl. On *Rhinanthus*. Walls.
 P. EPITRICA (Berk. & Br.) Sacc. On *Equisetum arvense*. Lerwick.
 P. FOVEATA Foister. On *Solanum tuberosum*. Northmaven, Unst.

- P. STAGONOSPOROIDES Trail. On *Molinia caerulea*. Yell.
 PHYLLOSTICTA GROSSULARIAE Sacc. On cultivated *Ribes grossularia*. Unst.
 P. HEDERICOLA Dur. & Mont. On *Hedera helix*. Unst.
 SEPTORIA AVENAE Frank. On *Avena sativa*. Mainland.
 S. CERASTII Rob. & Desm. On *Cerastium vulgatum*. Yell.
 S. LEONTODONTIS Sm. & Ramsb. On *Leontodon autumnalis*. Yell.
 S. LYCHNIDIS Desm. On *Lychnis dioica*. Unst.
 S. PAEONIAE Westend. On *Paeonia*. Lerwick.
 S. RIBIS Desm. On Blackcurrant. Walls.
 S. STELLARIAE Rob. & Desm. On *Stellaria media*. Unst. (I).
 VERMICULARIA cf. CULMIGENA Desm. On *Sieglingia decumbens*. Unst.

HYPHOMYCETEA.

- BOTRYTIS CINEREA Pers. ex Fr. On Cabbage, Walls; probably this species also on *Vicia faba* causing Chocolate Spot, Tingwall.
 CERCOSPORELLA PANTOLEUCA (Sacc.) Sacc. On *Plantago lanceolata*. Unst.
 CLADOSPORIUM CARPOPHILUM Thuem. On plum (*Prunus*). Lerwick.
 C. HERBARUM Link ex Fr. On *Leontodon autumnalis*. Yell. (I).
 DIDYMARIA KRIEGERIANA Bres. On *Lychnis dioica*. Yell.
 FUSARIUM CAERULEUM (Lib.) Sacc. On *Solanum tuberosum*. Unst, Dunrossness.
 F. LATRITIMUM Nees ex Fr. On *Ribes grossularia*. Unst. (Det. Dr. W. L. Gordon.)
 F. NIVALE (Fr.) Ces. On *Avena sativa*. Northmaven.
 HADROTRICHUM VIRESCENS Sacc. & Roum. On *Agrostis stolonifera*. Unst. (I).
 HELMINTHOSPORIUM VAGANS Drechsler. On *Poa pratensis*. Unst.
 H. VELUTINUM Link ex Fr. On *Ribes rubrum*. Unst.
 OOSPORA PUSTULANS Owen & Wakefield. On *Solanum tuberosum*. Dunrossness, Unst.
 OVULARIA OBLIQUA (Cooke) Oudem. On Rumex. Dunrossness, Unst. (I).
 RAMULARIA TARAXACI Karst. On *Taraxacum*. Unst. (I).
 RHYNCHOSPORIUM SECALIS (Oud.) Davis. On *Hordeum*. Dunrossness, Yell.
 SPONDYLOCLADIUM ATROVIRENS Harz. On *Solanum tuberosum*. Unst.
 STILBUM ERYTHROCEPHALUM Ditm. ex Fr. On sheep droppings. Yell.
 TRIPOSPORIUM CAMBRENSE Hughes. On *Calluna vulgaris*. Unst. (Det. Dr. M. B. Ellis.)

PLANT PATHOGENIC BACTERIA.

- BACTERIUM CAROTOVORUM (L. R. Jones) Lehmann & Neumann = *B. phytophthorum* (Appel) Stapp. Causing Blackleg of *Solanum tuberosum*. Unst, Mainland.
 PSEUDOMONAS CORONAFACIENS (Elliott) Stapp. Causing Halo Blight of *Avena sativa*. Northmaven.
 STREPTOMYCES SCABIES (Thaxter) Waksman & Henrici. Causing Common Scab of *Solanum tuberosum*. Dunrossness.

ACKNOWLEDGMENTS.

In addition to the various authorities to whom the determination of critical species is accredited in the above list, we are especially indebted to Dr. M. B. Ellis for suggesting the identity of *Phoma*

stagonosporoides, and to Professor Matthews for lending a slide of the type from the Trail herbarium, by comparison with which this suggestion was confirmed.

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POLLEN ANALYSIS OF A PEAT AT KINGSTEPS QUARRY, NAIRN.

By ELIZABETH M. KNOX.
(Heriot-Watt College, Edinburgh.)

(With Plate IX.)

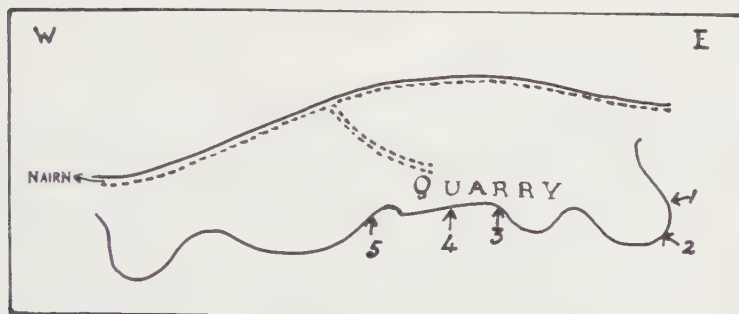
(Read by title, 14th January 1954.)

Our knowledge of the post-Glacial history of the Scottish flora is still imperfect, and little advance has been made since Erdtman's preliminary studies in 1924 and 1928 (*Geol. Fören. Förhandl.*, xliv, 50). Until more work is published dealing with the pollen content of peats in Scotland we cannot hope to apply the method of dating by pollen analysis with any certainty. The present investigation of the peat exposed in Kingsteps Quarry, Nairn was undertaken in the hope that the age of the peat might be determined and correlated with archaeological artifacts which have been found within it.

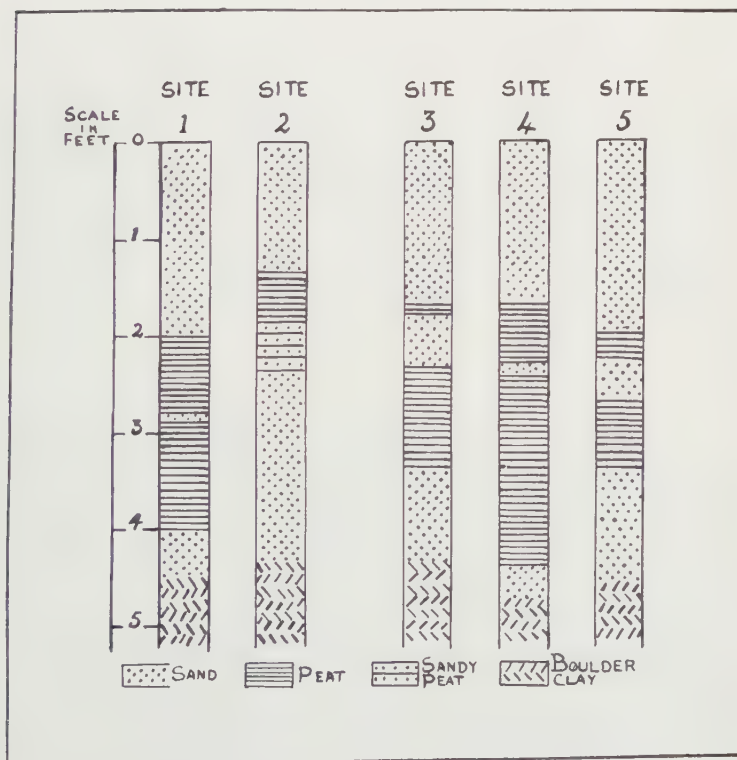
My attention was drawn to the site by Dr. J. B. Simpson who, from time to time, has collected stone artifacts from this peat layer. These artifacts, which are fashioned from quartz, chert, sandstone, etc., have been examined by Professor Lacaille and others, who suggest that in all probability they belong to the Mesolithic Period. They are, however, so rough and crude that it is impossible to indicate the particular culture of which they are the product.

Kingsteps Quarry lies one mile east of Nairn on the south side of the coast road, and 500 yards inland from high-water mark. For many years this quarry supplied sandstone of Old Red Sandstone age for building material for the newer part of the town. The superficial deposits seen in the quarry consist of blown sand on boulder clay, with an irregular but well-defined peaty layer in the sand. The thickness of the peaty layer does not exceed 2 feet 6 inches, while the total thickness of sand, including the peat, ranges up to about 10 feet (Plate IX). The surface level along the top of the quarry is somewhat undulating, at approximately 50 feet above sea-level; inland it falls slightly to the Auldearn road, south of which it rises again.

The peat layer is exposed at intervals along the face of the quarry which is about 400 yards in length. On the accompanying sketch



TEXT-FIG. 1.—Sketch plan of Kingsteps Quarry, Nairn.
The numbers indicate position of sites of sampling.



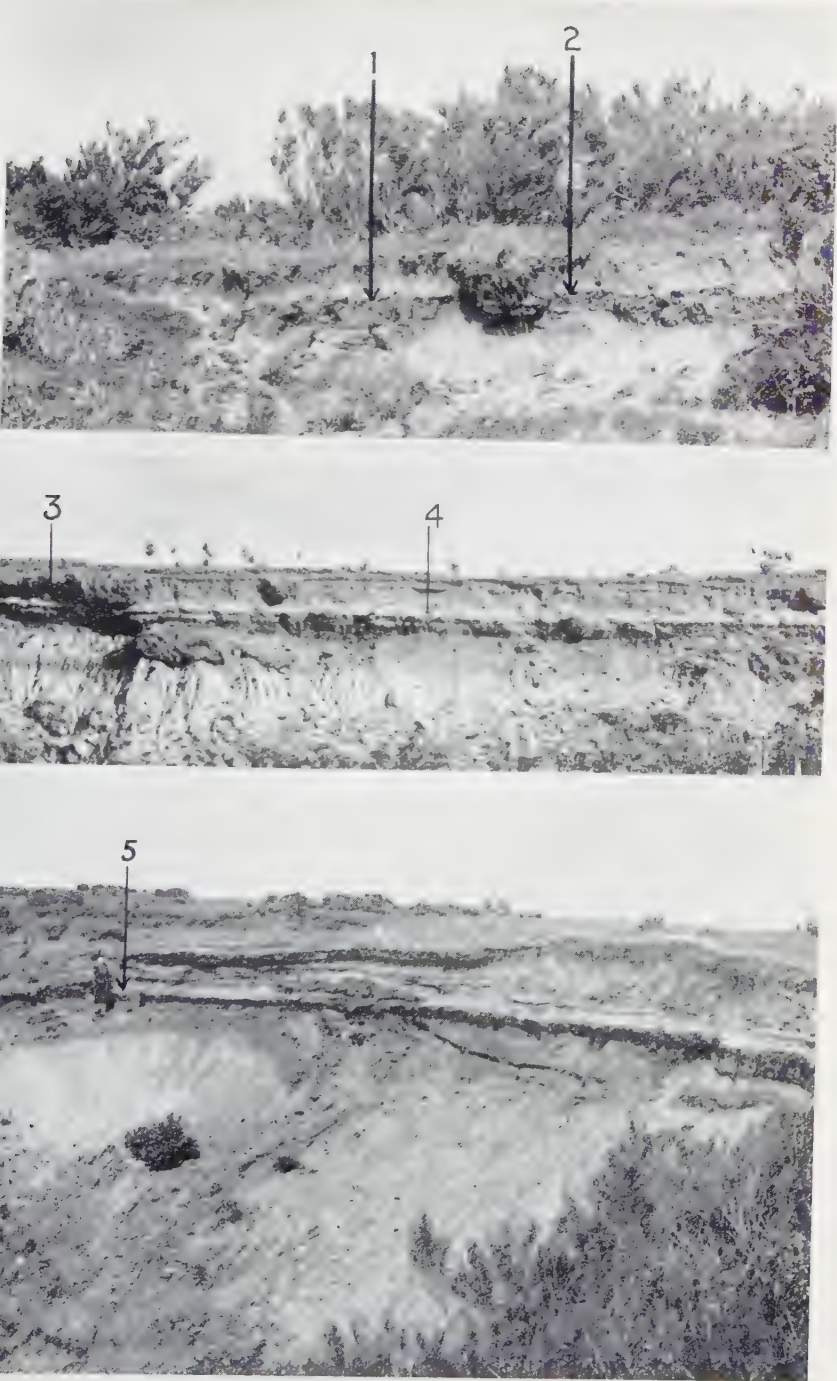
TEXT-FIG. 2.—Vertical sections at sites of sampling.

plan (fig. 1) the numbers indicate the sites where samples were taken for analyses. In the eastern embayment the peat is firm and compact; at site 1 it is 2 feet thick, thinning towards the west. Along the straight face between sites 3 and 5 the peat is variable both in thickness and in quality but at site 4 it attains the maximum recorded thickness of 30 inches, while at site 5 it is little more than a peaty sand distinguishable only by its darker colour and finer texture. The vertical sections (fig. 2) indicate the variable nature of the deposit at the 5 sites. Scattered throughout the peat are lenticles containing black charred fragments of wood, and from different levels small twigs of birch and hazel nuts have been picked out. At the eastern end, near site 1, Dr. Simpson noted some large flat-lying slabs of sandstone in the peat a few inches from the top of the bed, but with the crumbling of the bank these have now disappeared. We may surmise they were used as stepping-stones or as a stance at the edge of a shallow lake where a settlement may have been located. Towards the west of the area the conditions appear to have been drier and less suitable for the formation of peat.

POLLEN ANALYSIS.

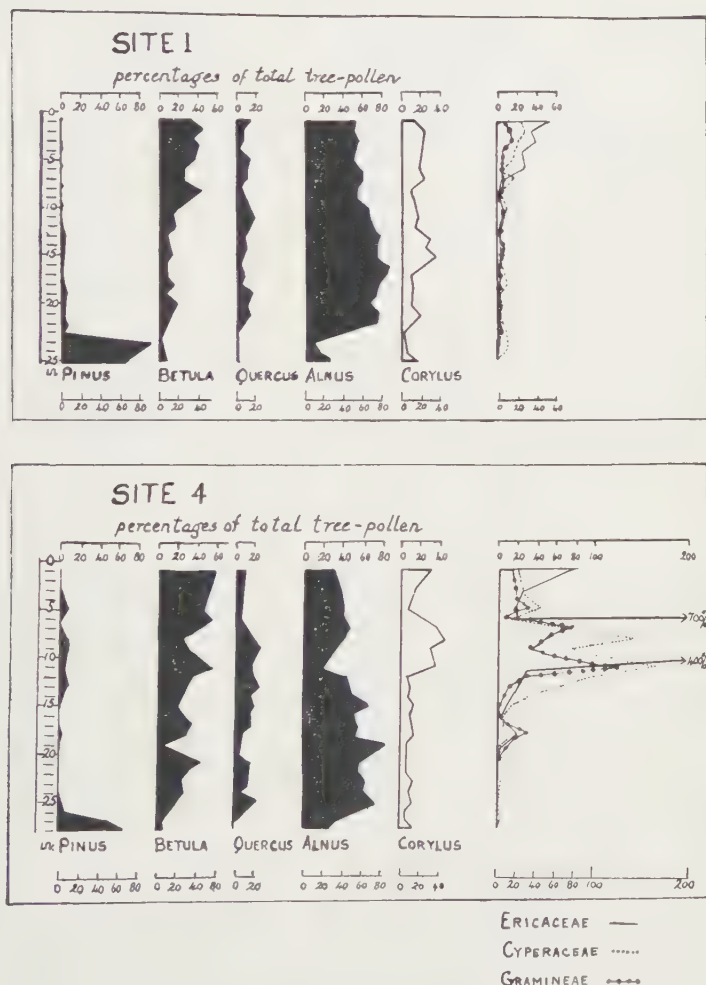
Pollen analyses were made from samples taken at all 5 sites marked on the sketch plan. The samples from sites 1 and 4 were collected by Dr. G. K. Fraser of the Macaulay Institute for Soil Research, who has kindly placed them at my disposal for analysis. The peat at these two points is at its thickest, whereas at sites 2, 3 and 5 it is interbedded with sand or sandy peat. Only the samples from sites 1 and 4 are described in detail. These samples, each 1 inch in diameter, were taken to form a continuous profile. For each sample 150 tree pollen grains were counted, except in a few instances where the pollen frequency was extremely low. The results of the pollen counts are expressed as percentages of total tree pollen, excluding *Corylus*. Non-tree pollen, including *Corylus*, is expressed as percentages of the total tree pollen. The percentages for each sequence of samples are combined in the form of a pollen diagram.

The pollen diagrams of the two sites 1 and 4 (fig. 3) exhibit a marked similarity. A notable feature is the high percentage of *Pinus*, reaching 90 per cent., at the base of each section, dropping rapidly upwards to less than 10 per cent. At the same time, in the basal layers, the percentage of *Betula* and *Alnus* is very low but rises steeply with the sudden reduction in *Pinus*. Where *Pinus* decreases



Kingsteps Quarry, Nairn, showing the position of sites 1, 2, 3, 4 and 5.

in amount. *Alnus* increases and becomes dominant. This *Pinus-Alnus* ratio is characteristic of the change from the Boreal to the Atlantic subdivision of post-Glacial time, the line of demarcation



TEXT-FIG. 3.—Pollen diagrams of sites 1 and 4.

being drawn at the point where the *Pinus* and *Alnus* curves cross one another. With the sudden increase in *Alnus* there is also an increase in *Quercus*; while towards the top of this peat *Betula* equals, and in some cases exceeds, *Alnus*. This part of the curve is typical of Atlantic peat profiles in general. At the base of the peat the

Boreal phase is represented by only a few inches of deposit. Immediately above and entering the Atlantic phase the peat is very rich in tree pollen, with relatively little admixture of ericoids, sedges or grasses. The uppermost 10 inches of the peat are recognisably different from the rest and characterised by a conspicuous increase in non-tree pollen, notably of Ericaceae and Cyperaceae. At both sites 1 and 4 there is a sandy layer, 8 to 10 inches from the upper surface of the peat. Immediately succeeding this sandy layer there is a marked increase in the percentage of herbaceous pollen. At site 4 two maxima of herbaceous pollen are observed, one before and one after the sandy facies. At different levels in the peat, fragments of charcoal occur but whether these are due to forest fires or to the burning of wood for domestic purposes, it is impossible to say.

The pollen analyses of samples from the sites 2, 3 and 5 yielded little of particular interest; the samples from these points were from portions only of the peat and were for the most part rather sandy. The pollen profiles conform nevertheless in their general pattern to the corresponding portions of sections taken at sites 1 and 4.

HERBACEOUS POLLEN.

Pollen of herbaceous plants other than ericoids, sedges and grasses is of infrequent occurrence. Plants of which the pollen has been recognised include a few of the Caryophyllaceae, Compositae of the taraxacum and matricaria groups, *Scabiosa*, *Plantago* (probably *P. maritima*), *Lonicera*, *Armeria*, *Chenopodium* with occasional spores of *Pteridium*, *Botrychium*, *Polypodium*, *Lycopodium*, *Selaginella*, *Sphagnum* and other Cryptogams. The small size of the Gramineae pollen grains precludes the likelihood of their being from cultivated varieties.

The site was in all probability a small lake of no great depth, having its margin clothed with pine forest during late Boreal times. With the changing climatic conditions which occurred in the early Atlantic period Pine almost disappeared, its place being taken by Birch-Alder scrub with some Oak. The herbaceous plants represented are in the main indicative of heath vegetation. The varying thickness of the peat and the sandy layers suggest some variability in the conditions of deposition; the conspicuous layer of sand noted at sites 1 and 4 may well be the result of a severe sandstorm in prehistoric times—and it is clear too that the lake itself was finally obliterated by heavier and continuous sandstorms—not unlike those to which the same region is subject at the present day.

It is probable that a Mesolithic settlement was situated in the vicinity. That the people were primitive is evidenced from the rough artifacts which have been found, and from the absence of any traces of pottery or of cultivation. The artifacts occurring throughout the peat have been dated as Mesolithic, and it is of interest that by pollen analysis the date of the peat has been found to be late Boreal to Atlantic.

The dating of the peat, however, can only be regarded as tentative since no other sections in the neighbourhood have been analysed and there is therefore no profile against which to check the results. If, however, our assumptions are correct, then in Kingsteps Quarry we have evidence of a Mesolithic coastal settlement in the late Boreal and early Atlantic Period.

ACKNOWLEDGMENTS.

Thanks are due to Dr. J. B. Simpson for drawing my attention to the site, to Dr. G. K. Fraser for collecting and allowing me samples for analysis, and to Professor I. A. Preece, Heriot-Watt College, for facilities to carry out the work in his department.

A CONTRIBUTION TO THE FLORA OF THE BEINN EIGHE NATURE RESERVE.

By B. W. RIBBONS.

(Department of Botany, University of Glasgow.)

(Read by title, 11th March 1954.)

The area now known as the Beinn Eighe Nature Reserve was so designated by the Nature Conservancy in November 1951. In 1952, the summer expedition * of the Glasgow University Botany Department was held at Kinlochewe in order to assist the Conservancy in amassing data about the area. The Reserve is wholly within the Watsonian Vice-County of West Ross (No. 105), and although the flora of this vice-county is reasonably well known, it is not usually possible to tell whether former records refer to the area of the Reserve (see p. 237).

The Reserve (see map, p. 237) is at the south-eastern end of Loch Maree (lat. $57^{\circ} 36' N.$) and occupies some 10,450 acres within the great deer forest of Kinlochewe. The main road from Kinlochewe to Gairloch along the side of Loch Maree (not the shore of the Loch) is the boundary to the north-east. The south-eastern boundary follows the road from Kinlochewe to Torridon; the village of Kinlochewe is excluded. About five and a half miles from Kinlochewe it turns sharply north along the Gairloch parish boundary, crossing the main ridge at just over 3000 feet. It continues north through the centre of Coire Ruadh-staca along Allt Coire Ruadh-staca as far as the junction of that stream with Allt Toll a'Ghiubhais, after which it continues along the ridge known as Druim Grudie until it meets the stream Allt Slocach. It follows this stream to meet the main road by Loch Maree about one and a half miles from Bridge of Grudie. Thus only the eastern part of the Beinn Eighe range is included, and it is perhaps a little unfortunate that the Reserve bears the name Beinn Eighe.

None of the area appears ever to have been cultivated, although sheep have been tried somewhat unsuccessfully. The chief use has been deer forest and grouse moor. The annual rainfall at Kinlochewe is about 80-90 inches.

* The following students assisted: J. D. Crosbie, R. J. Ferrie, J. T. Forrest, T. MacConnell, E. M. P. McGuinness, D. J. Moulton, and A. L. C. Robertson.
TRANS. BOT. SOC. EDIN., VOL. XXXVI. PT. III., 1954.

The highest point is Sgùrr Bàn (3188 ft.) from which a magnificent high quartzite ridge runs north-eastwards above Coire Domhain. There is a great hollow, Toll Bàn, between this ridge and the hill, Ruadh-stac Beag, while the other mountain of the Reserve, Meall a'Ghiubhais (2882 ft.), lies to the north across the valley of Toll a'Ghiubhais. The southern and eastern parts of the Reserve are covered with moorland and bog up to an altitude of about 1800 feet, and this region formerly suffered burning at intervals. The streams frequently lie in deep, usually wooded, gorges. In the north-east the lower slopes facing Loch Maree bear a remnant, Coille na Glas-leitire, of the old Caledonian forest and this is composed of native pines and birches. Overlooking the wood are crags and rock-ledges below Meall na h-Airidh-ardain, which bear a much richer flora than is found elsewhere in the Reserve. This is undoubtedly to be explained in terms of the geology.

GEOLOGY.

The Reserve lies to the east of the outcrop of the Moine Thrust and is predominantly upon the Cambrian rocks that traverse the north-west Highlands from Loch Eriboll to Loch Kishorn. This belt of Cambrian includes several well-known botanical localities, *e.g.* Inchnadamph, Knockanrock, where the Durness Dolomite and Limestone is exposed. Most of the Reserve is, however, composed of Cambrian Quartzite, which is singularly inhospitable to plants. The quartzite rests unconformably upon the older Torridonian Sandstone, and this rock, which is scarcely more suitable for plant life than is the quartzite, is exposed in the north and in the south. Beinn Eighe is a quartzite mountain as its steep, pinky-white, glistening scree slopes readily shew, but Meall a'Ghiubhais is formed of an outlying mass of displaced Torridonian Sandstone. The latter hill is the more interesting botanically, since below the thrust plane, at the base of the Torridonian, outcrop the dolomitic limestones, dolomitic shales and mudstones ("Furoid Beds"), and a band of quartzite and grit including decomposed dolomitic grit ("Serpulite Grit"), all of which belong to the Cambrian System. The composition and structure of these dolomitic shales, together with their mode of weathering, combine to produce a soil that is favourable to a large range of plant species. Where this occurs in a place having both adequate moisture and drainage, and protection from undue exposure, a rich flora may be expected. Such a situation occurs at about

1200 feet on the north and north-eastern sides of Meall a'Ghiubhais, where, below the Torridonian Sandstone, the escarpment between the fucoid beds and the basal limestone is formed by the serpulite grit. This area is denoted in the species list either as "craggs below Meall na h-Airidh-ardain" or as "craggs overlooking Coille na Glas-leitire".

Most of the woodland, Coille na Glas-leitire, is upon Torridonian Sandstone except for about half a mile a little north-west of Rhu Noa where Cambrian Quartzite covers the older rock. Undoubtedly the soil in and above the wood is influenced by drainage from the dolomitic rocks at the crags above.

The quartzite Beinn Eighe and its shoulder, Ruadh-stac Beag, are characterised by "mural precipices, splintered knife-edges, spiry cones and long bare scree slopes" (Hinxman, 1913), but south of Sgùrr na Conghair and in the north beyond Meall a'Ghiubhais the Torridonian Sandstone appears and exhibits numerous successive low terraces often with glaciated surfaces, bare of soil but strewn with boulders.

The effect of glaciation is most striking: above, that of ice-erosion, and below, of deposition. At the higher altitudes the effects of ice-erosion are seen in the steep-sided north-facing corries (*e.g.* below Sgùrr Bàn) and in the smooth glaciated surfaces of the sandstone (*e.g.* south of Sgùrr na Conghair). At the lower levels, especially in the west, east and south, the solid geology is completely masked by deposits of morainic materials. Most of the eastern half of the Reserve is so covered. The upper limit of the morainic drift is at about 750 feet in the south, but skirts Sgùrr na Conghair at 1000 feet and penetrates to 1750 feet in Coire Domhain. It continues north at about 1500–1600 feet to near Loch Allt an Daraich, and from there it falls away to within a short distance of the main road below Cnoc Donn. A small part of Coille na Glas-leitire is on moraine near Rhu Noa, and the same type of material fills Toll Bàn and Coire Ruadh-staca to a height of about 1800 feet and Toll a'Ghiubhais to about 1500 feet.

There is a considerable area of freshwater alluvium at about 1200 feet in Toll a'Ghiubhais, and similar but smaller patches are in Coire Ruadh-staca at about 1300 feet and 1400 feet. Recent deposits (peat) also occur in the east near Allt a'Chùirn and as a strip which follows the road from Cromasag north and north-westwards to Allt na Doire-daraich.

These notes on the geology are mostly derived from *Memoirs of the Geological Survey*, Geikie (1907), Peach *et al.* (1913 *a*) and (1913 *b*).

PREVIOUS RECORDS.

Only a few records for Vice-County 105 have been published since Druce's *Flora of West Ross* (1929). These are by Fernald (1931), Tansley (1939) and by various contributors to the *B.E.C. Reports* and to *Watsonia*. In most of the previously published records the localities given are too vague to enable one to decide whether the station is within the boundaries of the Reserve. Even the name "Beinn Eighe" is unhelpful (since the greater part of the mountain is outside the Reserve), and "Loch Maree" or "Kinlochewe" even less so.

In August 1881, Druce (Druce, 1929) almost certainly saw *Epilobium alsinifolium* within the Reserve as he was "walking from Kinlochewe along the Torridon Road, doing a little botanising on Ben Eay . . . until truculent keepers turned me back. Then through the deluge I walked on by Loch Clair and Loch Coulin. . . ."

Again (Druce, 1929), in 1887, "As usual the shooting people were curmudgeous and absolutely forbade permission to climb Ben Eay. As the mist was dense and a soft rain was falling, I walked up the Torridon Road, armed with umbrella and waterproof, sauntering as if for a constitutional. This road was raked by the telescopes of the keepers, but at a bridge over a stream I dropped into the gully and, leaving my impedimenta behind under the bridge I waded up the stream until well sheltered by the mist. In this way I got on to the white quartzite ridge which leads to the summit." Undoubtedly he waded in Allt a'Chùirn, and so the records he gives (*Agrostis canina*, *A. canina* var. *scotica*, *Cardaminopsis petraea*, *Polystichum lonchitis*, *Arctous alpina*, *Salix herbacea*, and several *Hieracia*) are for the Reserve.

Fernald's (Fernald, 1931) well-known visit to Kinlochewe, on which he claims to have found *Eriophorum* (= *Trichophorum*) *alpinum* and *E. opacum*, was in August 1930. The *E. alpinum* was growing along one rivulet in "a heathy and peaty slope to the south-east of the Hotel". This must be on the east side of A'Ghairbhe and so outside the Reserve. But Druce (1931, p. 285) says Fernald found it north-east of the Hotel, and comments that he himself had never been in that particular moor. The following year Druce (1932) saw *Malaxis* (= *Hammarbya*) *paludosa* frequent in Fernald's Marsh. But north-east or south-east—neither would be in the Reserve. However, on page 673 of the same volume, Fernald's locality for *Eriophorum alpinum* has become, according to Druce, "a marshy slope on the hillside south-west of Kinlochewe Hotel". Druce and

Corstorphine record *Scirpus* (= *Trichophorum*) *caespitosus* for this place. In spite of these errors of writing, the locality actually searched by Druce and Corstorphine (and by Wilmott and members of the Scottish Alpine Botanical Club (Adam, 1932)) was probably the correct one, and so would not be within the Reserve. The following probably refers to the Reserve: "On the lower slopes of Ben Eay we (Druce, 1932) found *Schoenus nigricans*, *Carex Sadleri* and a handsome hawkweed which Dr. Zahn names *H. triviale* Nörrl." In the list of New County and other Records for 1931 (Druce, 1932) the first two of these plants are given as from the north-west slope of Ben Eay.

Fernald's locality for *Eriophorum opacum* (— *E. brachyantherum*) (Fernald, 1931) might be within the Reserve: "In the wet peat along rills descending from the northern slopes of Ben Eigh were scattered plants of the most delicate species of monocephalus cotton grasses, *E. opacum*." Confirmation is necessary, however.

None of Druce's records marked "Ben Eay" can be for the northern part of the mountain as he (Druce, 1931) "got only on to the south side of Ben Eay—but never got on to the northern slopes". He does not appear to have been on the Beinn between 1889 and 1931. In 1889 he climbed (again in the face of difficulties from the keepers) particularly to collect *Agrostis canina* var. *scotica* (see also Druce, 1890) and so was probably inside the Reserve—as he almost certainly was in 1931. It is thus improbable that he was ever on the western half of the range and so most of his own records are likely to have come from the Reserve. Of the plants (excluding *Hieracia* and varieties) specifically mentioned for Ben Eay in Druce's *Flora*, 38 are on his own authority (we have recorded 29 of these), 2 are from Salmon and 1 from Talbot (we recorded none of these).

There are records for Beinn Eighe from Mackeehnie and Wallace (1949–1950), but these are for parts of the mountain beyond the Reserve. Russell (1900) gives *Trientalis europea* for Rhu Noa, and it is possible that this could be outside the boundary.

Tansley (1939) gives some lists for the pinewood, Coille na Glas-leitire, and for a small bog situated in a treeless area within the wood. The frequencies of the species agree with our observations.

PLACE-NAMES.

Many of the place-names referred to in the species list do not appear on the Ordnance Survey One Inch Map. For ease of reference a list is given here. The numbers are marked on the map (p. 237)

and refer to the grid squares (see p. 236). The names used are from the Six Inch Ordnance Survey Map of 1881 (1905 revision). These do not always agree with the names on the April 1881 edition of the map, and where this is so the names from the earlier edition appear in brackets.

ALLT A'CHÙRN, 41-44
 — A'GHILLE, 48, 55
 — AN ACHAI DH, 22, 23
 — BHANABHAIG (I) (=ALLT LOCH NA MNÀ BIGE), 6, 8, 9, 13
 — — (II) (=BEALACH NA H-AIRIDHE), 15, 20
 — COIR' AN LAOIGH, 46, 53
 — COIRE RUADH-STACA, 24, 31, 38
 — CRAOBH AN TÀIMH, 4, 5, 8
 — DEARG, 27, 34
 — DORCHAIG, 23
 — LOCH AN TUILL BHÀIN, 33, 39
 — NA CREIGE BÀINE, 18, 25
 — — CRICHE, 17, 22, 23
 — DOIRE-DARAICH, 23, 26-29
 — — H-AIRIDHE, 15, 16
 — NAN SAC, 53, 59
 — SQUABAIDH, 29, 30, 35
 — SLOCACH, 1, 4
 — TOLL A'GHIUBHAIS, 24-26, 33, 39
 ALLTAIN RUADH, 9, 10
 ALLTAN FEARNÀ, 49, 50
 — LEACACH, 28
 — MHIC EÒGHAINN, 16
 — NA CAISE, 49, 57
 AM FIONN-ALLTAN, 46, 53
 CADH' A'MHEANBH-CHRUIDH, 22
 CAOCHAN BÀN, 36, 37
 CÀRN ANTHONY, 59
 CARRAIG ALLTAN MHIC EÒGHAINN, 16, 22
 CATHAIR RUADH, 30
 CNOC DONN, 23
 — NA GAOITHE, 15
 COILLE NA GLAS-LEITIRE, 9, 10, 15, 16
 COIR' AN LAOIGH, 46

COIRE DOMHAIN, 40, 41
 — RUADH-STACA, 31, 38
 (CORRACH ALLT NA H-AIRIDHE), 14
 CREAG BHÀN, 19
 — DHUBH (I), 33
 — — (II), 18
 CREAGAN AN IME, 23
 — RUADH, 36
 CROMASAG, 44
 DOIRE-DARAICH, 29
 DROCHAD ALLT TOLL A'GHIUBHAIS, 26
 — BHANABHAIG (=DROCHAD ALLT LOCH NA MNÀ BIGE), 6
 DRUM GRUDIE, 4, 7, 12, 18
 EAS A'BHADAIN DUINN, 28
 — NAN CÙILEAG, 29
 FUARAN MÒR, 8, 9
 LEATHAD BUIDHE (I), 21, 22
 — — (II), 34
 LOCH ALLT AN DARAICH, 21
 — AN TUILL BHÀIN, 39
 — BHANABHAIG (I) (=LOCH NA MNÀ BIGE), 13
 — — (II) (=LOCH NA CORRAICH), 14
 MEALL A'GHIUBHAIS, 19
 — FEARNÀ, 36
 — NA H-AIRIDH-ARDAIN, 9, 14
 MEALLAN NA CIRCE-FRAOICH, 42, 43
 RHU NOA, 16
 RUADH-STAC BEAG, 32
 SGÙRR BÀN, 39, 46
 — NA CONGHAIR, 47, 48
 SLÙC COIR' AN LAOIGH, 45
 TOLL A'GHIUBHAIS, 24, 25
 — BÀN, 33, 39
 UAMH TOLL A' GHIUBHAIS, 24

ARRANGEMENT OF THE LIST.

The species which we have recorded are given in the list that follows. The nomenclature and the order of the species is that used in Clapham, Tutin and Warburg, *Flora of the British Isles*, 1952. The letters N and/or G are used to indicate the whereabouts of herbarium specimens:

N = The Herbarium of the Nature Conservancy, Edinburgh.

G = The Department of Botany, University of Glasgow.

Next come remarks on distribution and altitude *within the Reserve*. This condition is interpreted quite strictly; for example, "near Loch

Clair" means the nearest part of the *Reserve* to Loch Clair. Frequently there is a lack of convenient named landmarks and the names of places outside the Reserve are used (*e.g.* Loch Clair, Free Church Manse), but the area described is always within the boundary of the Reserve.

The numbers refer to the squares on the map (p. 237) from which we have recorded the species. These squares coincide exactly with the kilometre squares of the National Grid which are now printed on all the maps published by the Ordnance Survey. The squares which fall within the Reserve are numbered consecutively for convenience.

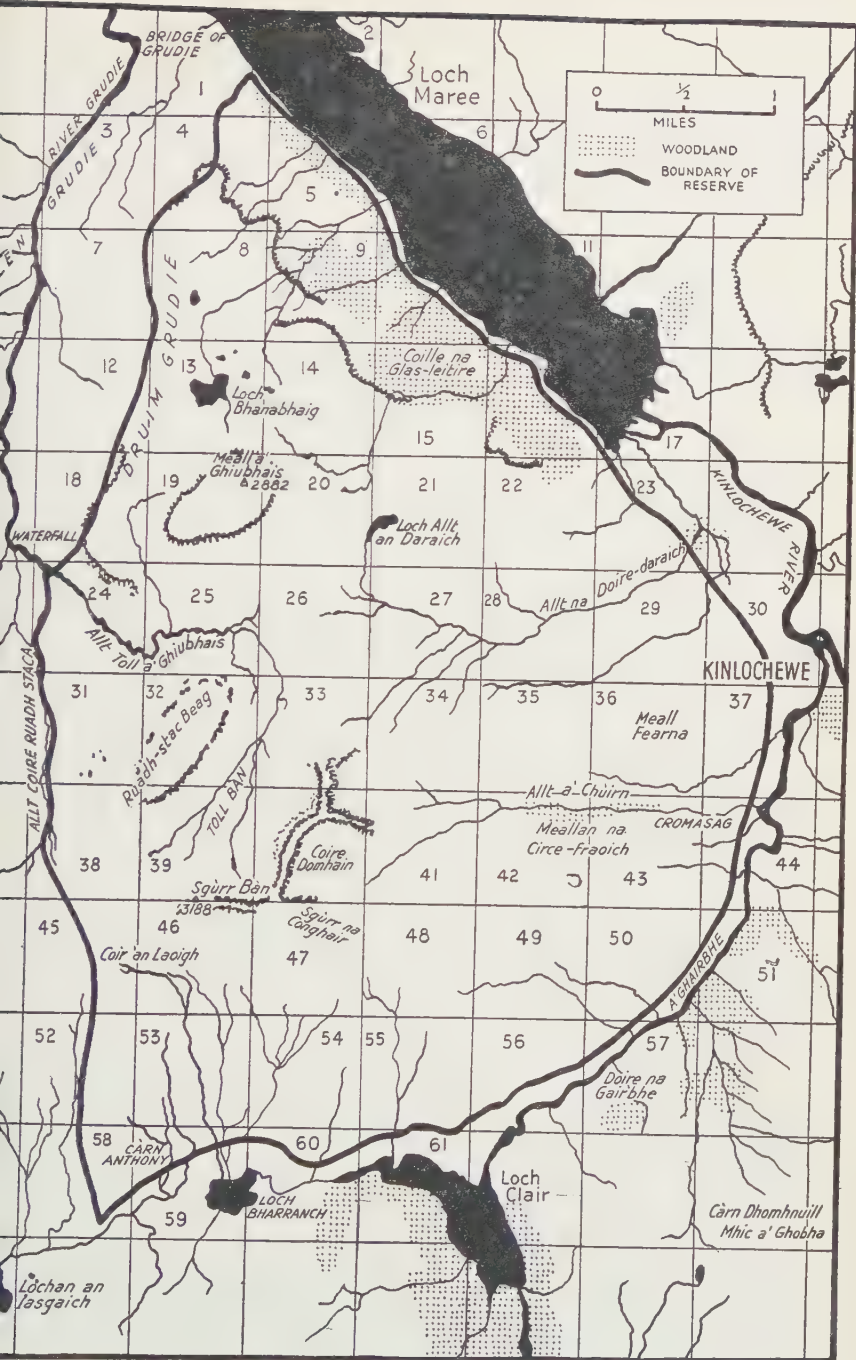
The localities (and square numbers) of the species marked with an asterisk have been omitted at the request of the Nature Conservancy. Included in the list are only those species which I have seen growing within the Reserve or of which I have seen a specimen collected at the time of our visit. I have omitted all other plants which appeared in our lists. Since the area is a *reserve*, the collecting of the voucher specimens was done with great care and the rarer plants were not collected at all. No plants were observed which are not plentiful in other parts of the country and, indeed, most of them are common on the hills surrounding the Reserve.

We visited as many parts of the area as possible and made lists of species for small areas such as a short length of stream-side or a few square yards of scree or bog. About 150 lists were made and it is intended to add to this number in the future. With this undergraduate party no serious attempt was made to deal with the critical species.

A total of 213 species was recorded, and a summary of their distribution is given in Table I, from which it is apparent that the

TABLE I.
DISTRIBUTION OF SPECIES.

Percentage of 213 Species.	Recorded from Squares.
Over 40 per cent.	9, 10, 15, 16
20-39 per cent.	4, 5, 14, 23, 27, 32, 33, 36, 44, 53, 59
10-19 per cent.	1, 2, 8, 19, 22, 26, 29, 35, 37, 38, 41, 42, 43, 46, 48, 49, 50, 56
Under 10 per cent.	13, 17, 18, 20, 21, 25, 31, 40, 47, 51, 57
Squares not examined	3, 6, 7, 11, 12, 24, 30, 34, 39, 45, 52, 54, 55, 58, 60, 61



MAP OF BEINN EIGHE NATURE RESERVE

richest floras are found in Coille na Glas-leitire and on the crags above. Thirty-eight species appear to be confined to the four squares, 9, 10, 15 and 16, and these are for the most part either woodland species or plants of base-rich soils.

LIST OF SPECIES.

LYCOPODIUM SELAGO L.

N, G.

Widely distributed above 500 feet and up to 3000 feet: upland stream-sides and exposed wet, stony, peaty places.

1, 4, 8, 9, 14, 15, 18, 19, 21, 27, 29, 31-33, 35, 36, 38, 40-42, 46, 48, 49.

*L. INUNDATUM L.

Very rare; seen once in wet moorland at c. 400 feet.

L. ALPINUM L.

N, G.

Common above 1500 feet (but descends to 1000 feet at the southern end of the Reserve) on screes and dry, stony, peaty places.

13, 14, 19, 32, 38, 40, 41, 48, 53.

SELAGINELLA SELAGINOIDES (L.) Link

N, G.

Seen rarely; up to 2000 feet; woodland stream-sides, peaty Callunetum on Ruadh-stac Beag, and crags below Meall na h-Airidh-ardain.

9, 10, 15, 32, 59.

EQUISETUM HYEMALE L.

N, G.

Caochan Bàn, at c. 200 feet near pool at stream. New to v.c. 105. (Confirmed by E. C. Wallace.)

36-37.

E. PALUSTRE L.

N, G.

On the lower hillside (c. 400 feet) at the Torridon Road, about opposite Loch Clair; and in a boggy pool on Meall Fearna.

36, 56.

E. SYLVATICUM L.

N, G.

Local below 1500 feet in the north and below 1000 feet in the east and south; rarely below 400 feet; stream-sides, damp areas in Mollinieta, ledges of crags above Coille na Glas-leitire, wet parts of birch wood; also at c. 1500 feet in Drochaid Allt Toll a'Ghiubhais and valley of Allt Toll a'Ghiubhais.

1, 9, 10, 14-16, 22, 23, 25, 26, 35-37, 42, 49, 53.

E. ARVENSE L.

N, G.

Seen once; in birch scrub at stream-side by Torridon Road.
c. 250 feet.

44.

HYMENOPHYLLUM WILSONI Hook.

N, G.

In Coille na Glas-leitire at c. 50 feet by stream-side in birch wood and at c. 250 feet on the banks of Allt na h-Airidhe; on tree trunks and rocks.

10, 16.

PTERIDIUM AQUILINUM (L.) Kuhn

Abundant but local up to 1000 feet in the north and east; local up to c. 500 feet in the south: stream-sides, especially in woods, dominant in many areas of better-drained ground about streams, above the wood, and in the felled parts of the wood.

1, 2, 4, 5, 9, 10, 15, 16, 22, 23, 29, 35, 36, 42-44, 49, 50, 53, 59.

**CRYPTOGRAMMA CRISPA* (L.) Hook. & Bauer

Seen once only; on quartzite scree at 2400 feet.

BLECHNUM SPICANT (L.) Roth

N, G.

Widespread up to 2500 feet; usually in sheltered places; absent from bogs and the highest screes.

2, 4, 5, 8-10, 13-16, 18, 19, 22, 23, 27, 29, 32, 33, 35-38, 41-44, 48-50, 53, 56, 59.

ASPLENIUM TRICHOMANES L.

N, G.

Up to 1500 feet on crags and rock-faces overlooking Coille na Glas-leitire; also in Allt na h-Airidhe (National Grid reference =001648).

9, 15, 16.

A. VIRIDE Huds.

N.

Up to 1500 feet on crags and rock-faces overlooking Coille na Glas-leitire; also in Allt na h-Airidhe (National Grid reference =001648).

9, 14-16.

ATHYRIUM FILIX-FEMINA (L.) Roth

N, G.

Up to 2000 feet in stream valleys and gorges, rocky sheltered places; occasional.

2, 9, 10, 15, 16, 32, 43, 44, 46, 53, 59.

CYSTOPTERIS FRAGILIS (L.) Bernh.

N, G.

From 500 to 1500 feet, on crags overlooking Coille na Glas-leitire; occasional.

1, 5, 9, 15.

DRYOPTERIS FILIX-MAS (L.) Schott

N, G.

Up to 800 feet in stream valleys and birch woods; also at c. 1000 feet on crags overlooking Coille na Glas-leitire; occasional.

5, 9, 10, 14-16, 23, 35-37, 44, 50, 53.

D. BORRERI Newm.

N, G.

Seen once; large scree at base of cliffs on Ruadh-stac Beag at c. 2200 feet.

32.

D. SPINULOSA (Müll.) Watt

N.

Ascends to 2000 feet but chiefly lowland in shady stream-sides and rocky places.

9, 10, 13, 15, 16, 23, 27, 32, 42, 48.

D. AUSTRIACA (Jacq.) Woynar

N, G.

Lowland (but on peaty hillside at 1800 feet, Ruadh-stac Beag), rocky places in stream-banks and Calluna moors and on cliff ledges.

4, 10, 16, 23, 27, 32, 50, 53.

POLYSTICHUM LOBATUM (Huds.) Woynar

N, G.

Occasional at c. 1000 feet on north-facing crags overlooking Coille na Glas-leitire.

9.

**P. LONCHITIS* (L.) Roth

N.

Rare at c. 1000 feet on certain crags.

THELYPTERIS OREOPTERIS (Ehrh.) C. Chr.

N, G.

Widespread up to 2000 feet, bouldery slopes, peaty hillsides, stream valleys and woods.

1, 2, 4, 5, 9, 10, 14-16, 27, 32, 33, 36, 37, 44, 50, 56, 59.

T. PHEGopteris (L.) Slosson

N, G.

Up to 1500 feet, local; sheltered shady corners among crags above, and stream-sides in, Coille na Glas-leitire.

4, 5, 9, 10, 14-16.

T. DRYOPTERIS (L.) Slosson

N, G.

Up to 1500 feet, seen only occasionally in sheltered shady places by streams and crags above Coille na Glas-leitire and in Allt na Doire-daraich.

9, 10, 16, 27.

POLYPODIUM VULGARE L.

N, G.

Lowland; up to 500 feet in the south-east and 1500 feet in the north-east; rocky ledges in stream-sides and woodlands; local.

4, 5, 9, 10, 15, 16, 44, 53.

LARIX DECIDUA Mill.

N, G.

Rare. Up to 500 feet; stream-sides, Alltan Mhic Eòghainn, Allt an Achaidh, and roadside between Kinlochewe Hotel and Loch Maree.

16, 17, 23.

PINUS SYLVESTRIS L. ssp. *SCOTICA* (Schott) E. F. Warburg

N.

Up to 1000 feet. Mature trees and seedlings in Coille na Glas-leitire, and deep gorges of Allt a'Chùirn and Allt Sguabaidh. Seedlings among rocks at the northern end of Druim Grudie and on moorland in the eastern part of the Reserve.

1, 2, 4, 5, 9, 10, 15, 16, 22, 27, 29, 36, 37, 42-44, 49.

JUNIPERUS COMMUNIS L. ssp. *COMMUNIS*

N, G.

Seen once at c. 100 feet in Coille na Glas-leitire; pine wood not far from Rhu Noa. (Det. E. F. Warburg.)

16.

J. COMMUNIS L. ssp. *NANA* (Willd.) Syme

N, G.

Between 500 and 2000 feet, but particularly between 1000 and 2000 feet on exposed stony hillsides. (Det. E. F. Warburg.)

1, 4, 8, 9, 14, 18-21, 27, 29, 32, 33, 35, 36, 38, 40-42, 46, 48, 49, 53.

CALTHA PALUSTRIS L.

N.

Rare; wet slope among boulders at c. 1800 feet in Drochaid Allt Toll a'Ghiubhais and by lochan at 1500 feet at the south end of Druim Grudie.

19, 20.

TROLLIUS EUROPAEUS L.

N, G.

Below Meall na h-Airidh-ardain from 500 to 1500 feet, common on rock ledges, also on grassy slopes and in stream gorges.

9, 14, 15.

ANEMONE NEMOROSA L.

N, G.

Seen twice in the birch wood alongside Loch Maree.

5, 15.

RANUNCULUS ACRIS L.

N, G.

Up to 2000 feet. Common on the crags above Coille na Glas-leitire and in the slopes and woodland below; elsewhere, occasional on stream-banks, peaty Callunetum, lochan margins, and wet areas about roadsides.

5, 9, 10, 14-16, 19, 23, 27, 32, 44, 50, 56, 59.

R. REPENS L.

N, G.

In birch scrub at Cromasag and dry stream-bed in Pteridetum above Coille na Glas-leitire.

9, 44.

R. FLAMMULA L.

N, G.

Occasional up to 1500 feet in wet places in woods, marshes and stream-sides.

10, 15-17, 19, 23, 26, 36, 37, 44, 56.

R. FICARIA L.

N, G.

In Pteridetum above Coille na Glas-leitire.

9.

THALICTRUM ALPINUM L.

N, G.

Between 1000 and 1500 feet on ledges of crags below Meall na h-Airidh-ardain and on thick peat at 1850 feet on Ruadh-stac Beag.

9, 14, 15, 32.

CARDAMINE PRATENSIS L.

N.

At 100 feet on the banks of Allt na h-Airidhe in Coille na Glas-leitire.

16.

C. FLEXUOSA With.

N, G.

Rare up to 1500 feet. Stream-sides, rock-ledges and open woodland in the north-east between Alltain Ruadh and Allt na h-Airidhe.

9, 10, 15, 16.

**CARDAMINOPSIS PETRAEA* (L.) Hiit. N, G.

Rare above 1500 feet on certain screes.

VIOLA RIVINIANA Rchb. N, G.

Locally common up to c. 1700 feet; damp places, lochan margins, stream-sides, woodland, ledges on crags below Meall na h-Airidh-ardain, roadsides.

1, 2, 4, 5, 9, 10, 14-16, 19, 23, 26, 33, 36, 37, 43, 44, 51, 59.

V. PALUSTRIS L. ssp. *PALUSTRIS* N, G.

Locally common in lowland stream-sides, woods, moorlands, and damp rock-ledges, also up to 2000 feet in damp peat and among rocks on Ruadh-stac Beag.

4, 9, 10, 15, 16, 22, 23, 26, 27, 32, 33, 36, 37, 44, 50, 59.

POLYGALA SERPYLLIFOLIA Hose N, G.

Widely distributed up to 2000 feet; stream-sides, bogs, peaty places, moorlands and wet rocky slopes.

1, 2, 4, 5, 8-10, 14-16, 21-23, 26, 27, 29, 32, 33, 35-38, 41, 44, 46, 48-50, 53, 56, 59.

HYPERICUM PULCHRUM L. N, G.

Lowland; streams, woods, moors, but up to 1500 feet on rock-ledges in the north-eastern part of the Reserve.

2, 4, 5, 9, 10, 14-16, 22, 23, 36, 43, 53, 56, 59.

**SILENE MARITIMA* With. N, G.

Above 1500 feet; uncommon on certain open screes. Not given by Druce as a mountain plant in W. Ross.

**S. ACAULIS* L. N, G.

Common at c. 3000 feet on certain summit detritus.

LYCHNIS FLOS-CUCULI L. N.

Seen once at 1800 feet on wet bouldery slope at Drochaid Allt Toll a'Ghiubhais.

20.

CERASTIUM VULGATUM L. N, G.

Local up to 2000 feet in the northern and eastern parts of the Reserve, especially on the rocky grassy slopes about the streams.

9, 15, 16, 20, 44.

SAGINA PROCUMBENS L.

N, G.

Seen at c. 100 feet on the banks of Allt na h-Airidhe in Coille na Glas-leitire.

16.

MONTIA LAMPROSPERMA Chamisso

N, G.

At c. 1250 feet in small runnel, Allt Toll a'Ghiubhais. (Det. S. M. Walters.)

25.

LINUM CATHARTICUM L.

N, G.

Rare; up to 1500 feet; Torridon roadside, ledges and rocky slopes below Meall na h-Airidh-ardain.

9, 14, 56.

GERANIUM ROBERTIANUM L.

N, G.

Rare; up to 1500 feet; woodland stream-side, Allt na h-Airidhe, and crags north of Meall na h-Airidh-ardain.

9, 16.

OXALIS ACETOSELLA L.

N, G.

Up to 1500 feet; common in sheltered stream-sides, Allt a'Chùirn and those on the north-eastern boundary and on rock-ledges and slopes below Meall na h-Airidh-ardain.

5, 9, 10, 14-16, 22, 23, 42, 44.

ACER PSEUDOPLATANUS L.

N.

C. 350 feet in moorland, Meall Fearna.

36.

ILEX AQUIFOLIUM L.

N, G.

Up to c. 1000 feet; usually as isolated trees; Allt a'Chùirn and stream-sides and rocky places about the woods in the north-east.

4, 9, 10, 15, 16, 43.

ULEX EUROPAEUS L.

N, G.

Up to c. 500 feet; occasional in woodland and scrub near road-sides, lower stream-sides, and dry rocks.

2, 4, 5, 17, 33, 44.

SAROTHAMNUS SCOPARIUS (L.) Wimmer

N, G.

Rare; stream-banks near road, Allt an Fearna and in scrub by Allt a'Chùirn.

44, 50.

TRIFOLIUM PRATENSE L.

N, G.

C. 200 feet stream-side, Alltan Fearna.

50.

T. REPENS L.

N, G.

Uncommon; roadside near Allt a'Chùirn and Alltan na Caise;
up to 1000 feet in and above Coille na Glas-leitire.

9, 15, 16, 44, 57.

LOTUS CORNICULATUS L.

N, G.

Local and uncommon; roadside near Alltan na Caise and Allt
a'Chùirn, by the side of Caochan Bàn and on grassy slope above
the source of Alltain Ruadh.

9, 36, 44, 57.

FILIPENDULA VULGARIS Moench

N, G.

Local in the north-east, up to c. 1300 feet; stream-sides, woods,
north-facing rock-ledges below Meall na h-Airidh-ardain and grassy
slopes towards wood.

9, 10, 15, 23.

RUBUS CHAMAEMORUS L.

N, G.

Locally abundant between 500 and 2000 feet; upland stream-
sides and peaty Calluneta in the central part of the Reserve.

13, 15, 20, 25-27, 29, 33, 41.

***R. SAXATILIS L.**

N.

Seen once at c. 1300 feet.

R. IDAEUS L.

N, G.

At c. 50 feet by roadside near head of Loch Maree and at c. 1300
feet among large boulders above Coille na Glas-leitire.

9, 17.

R. NEMORALIS P. J. Muell

N.

Roadside. (Det. W. Watson.)

POTENTILLA ERECTA (L.) Räusch.

N, G.

Abundant and widespread up to 2000 feet; absent from the more
sheltered stream-sides.

1, 2, 4, 5, 8-10, 13-16, 18, 19, 21-27, 29, 31-33, 35-38, 41-44, 46,
48-50, 53, 56, 57, 59.

FRAGARIA VESCA L.

N, G.

C. 1250 feet on north-facing crags above Coille na Glas-leitire.

9.

GEUM RIVALE L.

N, G.

Up to 1500 feet; rock-ledges on crags below Meall na h-Airidh-ardain and slopes below; stream-sides in Coille na Glas-leitire and roadsides near head of Loch Maree.

9, 10, 14-16, 23.

ALCHEMILLA ALPINA L.

N, G.

Common in rocky places, older talus and screes above 1000 feet; occasionally at lower altitudes in dry stream-sides and slopes below crags in the north-east.

4, 9, 10, 14-16, 19, 20, 24, 26, 32, 33, 38, 40, 41, 44, 46, 48, 59.

A. FILICAULIS Buser

N.

C. 1250 feet on flushed grassy ledges of crags above Coille na Glas-leitire. (Conf. S. M. Walters.)

14.

A. GLABRA Neygenfind

N, G.

C. 600 feet in Pteridetum above Coille na Glas-leitire. (Conf. S. M. Walters.)

ROSA spp.

N, G.

Specimens from lowland parts of the Reserve probably include *R. Afzeliana* Fr., *R. canina* L., and *R. Sherardi* Davies. (Seen by N. Y. Sandwith.)

PRUNUS PADUS L.

N, G.

C. 100 feet on banks of Allt na h-Airidhe.

16.

SORBUS AUCUPARIA L.

N, G.

Trees widespread up to 1500 feet in rocky stream-sides and rock-ledges in the north-east; seedlings occasionally in woods and peaty Calluneta; up to 2000 feet in Coire Ruadh-staca.

1, 2, 4, 5, 8-10, 14-17, 22, 23, 27, 29, 33, 35, 36, 38, 41-44, 49, 50, 53.

SEDUM ROSEA (L.) Scop.

N, G.

C. 700–1200 feet on north-facing rock-ledges below Meall na h-Airidh-ardain.

9.

SAXIFRAGA STELLARIS L.

N, G.

From roadsides up to 3000 feet, usually in wet places, stream-banks, peaty flushes, rock-ledges and among boulders at top of Sgùrr Bàn.

9, 13–16, 19, 26, 27, 32, 33, 40, 41, 43, 44, 59.

S. AIZOIDES L.

N, G.

Rare; at 1000 and 1500 feet on damp rock-ledges and rocky stream-sides between Alltain Ruadh and Allt na h-Airidhe.

9, 14, 15.

**S. OPPOSITIFOLIA* L.

N, G.

Seen once only; at 1250 feet on certain crags.

CHRYOSPLENIUM OPPOSITIFOLIUM L.

N, G.

Local in wet places up to 1500 feet; small streams in woods and rock-ledges between Alltan Mhic Eòghainn and Alltain Ruadh.

9, 10, 15, 16.

PARNASSIA PALUSTRIS L.

N, G.

Seen once; at 1250 feet on north-facing crags below Meall na h-Airidh-ardain.

9.

DROSER A ROTUNDIFOLIA L.

N, G.

Lowland; common up to 1000 feet (but at 1600 feet at Druim Grudie); wet places, stream-sides, bogs, and peaty places.

1, 2, 4, 8, 10, 15, 16, 22, 23, 29, 35, 36, 43, 44, 49, 50, 56, 59.

D. ANGLICA Huds.

N, G.

Lowland, scarcely up to 1000 feet; in similar places to *D. rotundifolia* but more local.

1, 4, 16, 23, 29, 35, 36, 43, 49, 50, 56, 59.

**EPILOBIUM MONTANUM* L.

N, G.

Rare; at 1250 feet in a flushed area near certain crags and at 50–100 feet in the wood by the banks of certain streams.

E. PALUSTRE L.

N, G.

Locally common up to c. 1500 feet; Toll a'Ghiubhais, stream-sides in woods; rocky slopes to the south-west and north-east of the crags below Meall na h-Airidh-ardain.

9, 10, 15, 16, 22, 25.

CIRCAEA INTERMEDIA Ehrh.

N.

Seen once; at 50 feet by stream-side in birch wood.

10.

CALLITRICHE INTERMEDIA G. F. Hoffm. ssp. HAMULATA (Kütz.)

Clapham

N, G.

C. 1500 feet by Allt Toll a'Ghiubhais, in a small runnel and in a shallow pool.

25, 26.

CHAMAEPERICLYMENUM SUECICUM (L.) Aschers. & Graebn.

N, G.

Local, above 1500 feet usually with *Vaccinium myrtillus* on thick peat, but in small scree on steep side of Coire Ruadh-staca at 2200 feet.

9, 13, 18, 21, 32, 38, 46.

HEDERA HELIX L.

Lowland stream-sides and woods from Alltain Ruadh, northwards.

5, 9, 10.

SANICULA EUROPAEA L.

N, G.

Up to 1200 feet; occasional in woodland stream-sides in north-east and on the wet crags above.

4, 5, 9, 10, 14, 15, 23.

CONOPIDIUM MAJUS (Gouan) Lor. & Barr.

N, G.

Up to 1200 feet; occasional about stream-sides and crags from Allt an Achaidh to Alltain Ruadh.

9, 10, 15, 16, 23.

ANGELICA SYLVESTRIS L.

N, G.

Up to 1500 feet, local; sheltered places in birch scrub near Cromasag, stream-side of Allt na h-Airidhe and below Meall na h-Airidh-ardain.

9, 16, 44.

RUMEX ACETOSELLA L.

N, G.

Below 1000 feet; local; by streams from Alltan Fearna to Allt na h-Airidhe and about Carraig Alltan Mhic Eòghainn.

15, 16, 22, 23, 36, 37, 44, 50.

R. ACETOSA L.

N, G.

Lowland; near streams and usually below 500 feet (as at Allt nan Sac, Alltan Fearna, Cromasag, and Allt na h-Airidhe), but at 1400 feet by Allt Toll a'Ghiubhais and on cliff above Alltain Ruadh.

9, 16, 33, 44, 50, 59.

MYRICA GALE L.

N, G.

Common up to 700 feet (but at c. 1000 feet in Allt a'Chùirn and Allt Sguabaidh); stream-sides and wet moors in the north beyond Allt Craobh an Taimh and from Allt an Mhic Eòghainn to Càrn Anthony.

1, 2, 4, 16, 22, 23, 29, 35-37, 41-44, 49, 50, 53, 59.

BETULA PUBESCENS Ehrh. ssp. *ODORATA* (Bechst.) E. F. Warburg

N, G.

Up to 1000 feet; northwards from Allt an na Caise as scrub about streams, especially common in the north-east and forming woodland in parts of Coille na Glas-leitire. (Det. E. F. Warburg.)

1, 2, 4, 5, 9, 10, 14-16, 22, 23, 29, 36, 42-44, 49-50.

ALNUS GLUTINOSA (L.) Gaertn.

N, G.

Lowland; occasional by streams from Caochan Bàn northwards.

5, 10, 15, 16, 23, 35-37.

QUERCUS PETRAEA (Mattuschka) Liebl.

N, G.

Very rare; a few scattered trees near Allt na Criche, seedlings near Allt na h-Airidhe. (Det. R. D. Meikle.)

16, 17.

SALIX ATROCINEREA Brot.

N, G.

Below 1000 feet; local; woodland, stream gorges and wet boulders; in wet birch wood, Coille na Glas-leitire, and in gorge at northern end of Druim Grudie and (probably this species) near Allt Coir' an Laoigh and other similar places. (Det. R. Mackechnie and R. D. Meikle.)

4, 15, 16, 53.

S. AURITA L.

N, G.

Up to 500 feet; moors near streams, Allt nan Sac, Cromasag, Allt an Achaidh, Allt na Crìche, and Allt na h-Airidhe. (Det. R. Mackechnie and R. D. Meikle.)

16, 23, 44, 59.

S. REPENS L. ssp. *REPENS*.

N, G.

Local in rocky places; seen at c. 1000 feet, northern end of Druim Grudie above Allt na Crìche and near the path by Allt na Doire-daraich.

4, 22, 27.

S. HERBACEA L.

N, G.

From 800 to 3000 feet; local in rocky places: seen on Sgùrr na Conghair, Drochaid Allt Toll a'Ghiubhais and near Cnoc na Gaoithe.

14, 27, 47.

LOISELEURIA PROCUMBENS (L.) Desv.

N, G.

Above 2000 feet on small dry scree around Coire Domhain and south-east side of Ruadh-stac Beag.

32, 40, 41, 48.

ARCTOSTAPHYLOS UVA-URSI (L.) Spreng.

N, G.

From 1000 to 2500 feet; abundant on exposed wind-swept rocky and/or peaty hillsides, especially at c. 1200 feet; also on stream-banks.

13-15, 19, 26, 27, 29, 33, 35, 36, 38, 41, 42, 48, 53.

ARCTOUS ALPINA (L.) Niedenzu

N, G.

From 1000 to 2000 feet; locally abundant (especially at c. 1300 feet) on very exposed bare stony or peaty hillsides.

14, 19, 21, 32, 33, 46, 48, 53.

CALLUNA VULGARIS (L.) Hull

N, G.

Abundant and widespread up to c. 1500 feet in the south, but elsewhere thinning out up to 2000 feet.

1, 2, 4, 5, 8, 10, 14-16, 18, 19, 21-27, 29, 31-33, 35-38, 41-44, 46, 48-50, 53, 56, 59.

ERICA TETRALIX L.

N, G.

Widely distributed and common in damp peaty places up to 1500 feet extending to wetter places than *E. cinerea*.

1, 2, 4, 8, 15, 16, 22, 23, 27, 29, 31, 33, 35-38, 41, 43, 44, 49, 50, 53, 56, 59.

E. CINEREA L.

N, G.

Widespread and common up to c. 1700 feet, extending to certain drier places than *E. tetralix*.

1, 2, 4, 5, 8, 10, 15, 16, 22, 23, 27, 29, 32, 33, 35-38, 41, 43, 46, 49-50, 53, 57, 59.

VACCINIUM VITIS-IDAEA L.

N, G.

Locally common: woodland below Carraig Alltan Mhic Eòghainn up to c. 600 feet, peaty heaths west of Ruadh-stac Beag, 1400-2200 feet. Coir' an Laoigh, 1800 feet, head of Allt a'Chùirn and Allt na Doire-daraich. Alltain Ruadh, and Allt Croabh am Tàinmh, and at 400 feet near Allt Coir' an Laoigh.

8, 9, 16, 21, 22, 26, 32, 33, 41, 42, 53.

V. MYRTILLUS L.

N, G.

Abundant in lowland shady places: in scrub and especially in woodlands of the north-east; up to 3000 feet on exposed bouldery hillsides and upland stream-sides.

1, 4, 5, 8-10, 13-16, 18-27, 29, 32, 33, 35, 38, 41-44, 46-49, 53.

V. ULIGINOSUM L.

N, G.

Local above 1500 feet; on hillsides among large boulders, Coir' an Laoigh, Coire Domhain, west side of Ruadh-stac Beag, Meall a'Ghiubhais.

13, 19, 32, 38, 41, 46, 53.

**PYROLA MEDIA* Sw.

N.

Seen once in a dry stream-bed at c. 1100 feet.

EMPETRUM NIGRUM L.

N, G.

Local and occasional among rocks by stream-sides below 1500 feet, but seen at 2000 feet on the west side of Ruadh-stac Beag and at 1700 feet in boggy ground at Coire Ruadh-staca; also in birch wood, Coille na Glas-leitire, at c. 250 feet.

8, 15, 27, 31-33, 48, 53.

E. HERMAPHRODITUM (Lange) Hagerup

N, G.

Commoner than *E. nigrum*; above 1000 feet; usually in rocky exposed upland stream-sides and screes; at 3160 feet on summit of Sgùrr na Conghair.

8, 9, 19, 27, 32, 33, 38, 40, 42, 46-48, 53.

ARMERIA MARITIMA (Mill.) Willd.

N, G.

From 1000 to 2500 feet; locally abundant on small scree, Sgùrr na Conghair, Coire Domhain, Ruadh-stac Beag, and Meall a'Ghiubhais.

19, 26, 32, 38, 40, 41, 48.

PRIMULA VULGARIS Huds.

N, G.

Up to 1200 feet; common in damp wooded stream-sides from Allt an Achaidh north-westwards and on crags above the wood, also at Torridon roadside about opposite to Loch Clair.

4, 5, 9, 10, 15, 16, 23, 56.

LYSIMACHIA NEMORUM L.

N, G.

Local up to 1200 feet; wet places, stream-sides and rock-ledges, Coille na Glas-leitire, also on wet scree below Coir' an Laoigh.

5, 9, 10, 15, 16, 53.

**TRIENTALIS EUROPAEA* L.

N, G.

Very rare; seen once only at c. 50 feet.

MENYANTHES TRIFOLIATA L.

Very rare; seen once only in small upland pool at 1800 feet, Drochaid Allt Toll a'Ghiubhais.

26.

MYOSOTIS SECUNDA Murr.

N, G.

Rare; up to 1000 feet wet places in birch wood and streams.

10, 15, 17.

DIGITALIS PURPUREA L.

N, G.

Scattered up to 1500 feet in the north-east; stony strands in stream-sides, stream-banks, moors and crags above the woods of the north-east; near the source of Allt na Doire-daraich, stream near Càrn Anthony and at 2200 feet on scree in Coire Ruadh-staca.

9, 10, 15, 16, 22, 23, 26, 27, 38, 59.

VERONICA OFFICINALIS L.

N, G.

Local; wet stony places up to 1200 feet; about Coille na Glas-leitire, near Càrn Anthony and on quartzite scree on the ridge to the north of Coire Domhain.

2, 5, 9, 10, 14-16, 41, 59.

V. CHAMAEDRYIS L.

N, G.

Uncommon; up to 1200 feet about Coille na Glas-leitire, grassy banks and slopes with boulders.

9, 15, 16, 23.

V. SERPYLLIFOLIA L.

N.

Seen once at c. 800 feet on flushed grassland in birch wood, Coille na Glas-leitire. (Conf. R. Mackechnie.)

10.

V. ARVENSIS L.

N.

Seen once at c. 1250 feet on flushed ledges of crags above Coille na Glas-leitire. (Conf. R. Mackechnie.)

14.

PEDICULARIS SYLVATICA L.

N, G.

Up to 1000 feet in the south-east, to 1700 feet in the north-east and to 2000 feet on the east side of Ruadh-stac Beag; scattered in wet moorlands and stream-banks. Not seen in the central western area.

1, 4, 8, 10, 15, 16, 21-23, 26, 27, 29, 32, 33, 35-37, 42-44, 49, 50, 53, 56, 59.

RHINANTHUS STENOPHYLLUS (Schur.) Druce

N, G.

Seen at c. 250 feet; Torridon road near Alltan na Caise. (Det. E. F. Warburg.)

57.

R. SPADICEUS Wilmott

N, G.

Near source of Alltain Ruadh, c. 1000 feet; grassy bouldery slope below crags. (Det. E. F. Warburg.)

9.

R. BOREALIS (Sterneck) Marshall

N, G.

At c. 1000 feet on grassy bouldery slopes above the source of Alltain Ruadh and on crag-ledges above. (Det. E. F. Warburg.)

9.

MELAMPYRUM PRATENSE L.

N, G.

Locally frequent up to 3000 feet in damp sheltered peaty places; Coir' an Laoigh, Sgùrr na Conghair, Allt a'Chùirn, Drochaid Allt Toll a'Ghiubhais, Allt na Creige Bàine, northern end of Druim Grudie, occasional but scattered in Coille na Glas-leitire.

9, 10, 15, 16, 22, 23, 25, 27, 33, 41-44, 46, 47, 53.

EUPHRASIA OFFICINALIS agg.

Scattered; along the Torridon road, about Coille na Glas-leitire and crags above; up to 2000 feet in numerous places north of Toll Bàn and Allt Sguabaidh.

4, 9, 10, 14-16, 18, 20, 23, 26, 33, 35, 38, 44, 56, 57, 59.

E. CONFUSA Pugsl. f. *ALBIDA* Pugsl. N, G.

Seen by stream-side in birch wood (the stream south of Alltain Ruadh) at c. 50 feet; on wet peaty slope at 1800 feet at Drochaid Allt Toll a'Ghiubhais, and in a dry stream channel at c. 450 feet near Càrn Anthony. (Det. E. F. Warburg.)

10, 20, 59.

E. BREVIPILO Burnat & Gremli N, G.

Seen in Coille na Glas-leitire by side of Allt na h-Airidhe at 100 feet and by roadside bridge at Allt a'Chùirn. (Det. E. F. Warburg.)

16, 44.

**PINGUICULA LUSITANICA* L.

Seen only on a hillside at c. 400 feet where it is very occasional.

P. VULGARIS L. N, G.

Widespread and common up to 2000 feet in damp places.

1, 4, 5, 8-10, 13-16, 21-23, 26, 27, 29, 31-33, 35-37, 41-44, 46, 48-50, 56, 59.

THYMUS DRUCEI Ronn. N, G.

Local; up to 2200 feet; but, in the south, in dry stream-sides and screes at roadside level and above c. 1800 feet (*i.e.* not in the intervening peat moors); frequent in the north on the crags below Meall na h-Airidh-ardain. (Conf. C. D. Pigott.)

9, 14, 15, 26, 27, 33, 38, 44, 46, 48, 57, 59.

PRUNELLA VULGARIS L. N, G.

Up to 1200 feet; occasional in damp places about Coille na Glas-leitire, Allt a'Chùirn, and near Loch Clair.

9, 15, 16, 23, 43, 44, 56.

TEUCRIUM SCORODONIA L. N, G.

Up to c. 500 feet; on drier ground near streams, Allt Coir' an Laoigh and Allt nan Sac; also in the north-east.

5, 10, 16, 53, 59.

AJUGA REPTANS L.

N, G.

Seen at c. 100 feet in wet birch wood near Rhu Noa.

15.

PLANTAGO LANCEOLATA L.

N, G.

Up to 1400 feet on rock-ledges and by streams about Coille na Glas-leitire, also below 500 feet from Loch Clair northwards, road- and stream-sides; not uncommon.

9, 10, 14-16, 23, 36, 37, 50, 56, 57.

P. MARITIMA L.

N.

Seen on bouldery slopes (at c. 800 feet and 1200 feet) below the north-facing crags above Alltain Ruadh.

9.

GALIUM HERCYNICUM Weigel

N, G.

Up to 2500 feet; widespread and common except on peat moors in the south.

1, 2, 4, 5, 8-10, 13, 15, 16, 18, 22, 23, 26, 27, 29, 32, 33, 35-38, 41, 42, 44, 48-50, 57.

G. PALUSTRE L. ssp. *PALUSTRE*

N, G.

Locally frequent below 500 feet in Coille na Glas-leitire; Pteridetum, wet birch wood, and sides of Alltan Mhic Eòghainn. (Conf. R. Mackechnie.)

9, 10, 15, 16.

LONICERA PERICLYMENUM L.

N, G.

Local below c. 500 feet; stream-sides and woodland, Coille na Glas-leitire, and in bouldery Callunetum-Pteridetum near Allt Coir' an Laoigh.

5, 10, 15, 16, 22, 23, 53, 59.

VALERIANA OFFICINALIS L.

N, G.

Occasional below 1500 feet from Allt na Crìche northwards; stream-banks and rock-ledges above Alltain Ruadh.

5, 9, 10, 16, 17.

SUCCISA PRATENSIS Moench

N, G.

Common up to 2500 feet in most damp places. (Det. R. Mackechnie.)

4, 8-10, 15, 16, 27, 32, 38, 48, 53, 56, 59.

SENECIO JACOBAEA L.

N, G.

Lowland (up to 1500 feet in the north-east); drier places in stream-sides and crags in and above Coille na Glas-leitire, also near road at Allt a'Chùirn and near Allt nan Sac.

9, 10, 14-16, 23, 44, 59.

TUSSILAGO FARFARA L.

N.

Seen once at 1250 feet on north-facing crags below Meall na h-Airidh-ardain.

9.

*GNAPHALIUM SUPINUM L.

N, G.

Seen once at 2600 feet on stable quartzite small scree.

ANTENNARIA DIOICA (L.) Gaertn.

N, G.

Above 1000 feet; common on exposed shoulders of hills, in small scree and in high heathy places; seen at 400 feet in rocky stream-side near Allt nan Sac.

4, 8, 14, 18, 19, 26, 27, 33, 36, 38, 40, 41, 46, 48, 53, 59.

SOLIDAGO VIRGAUREA L.

N, G.

Up to 2500 feet; occasional but widespread in rocky (and sometimes in peaty) places on mountains and in streams.

4, 9, 10, 13, 14, 16, 18, 19, 27, 29, 32, 33, 35, 38, 41, 43, 44, 46, 48, 53, 59.

BELLIS PERENNIS L.

N, G.

At c. 1200 feet on rock-ledges above Coille na Glas-leitire, rather rare; also seen near road between Allt an Achaidh and Allt na Crìche.

9, 15, 23.

ACHILLEA MILLIFOLIUM L.

Seen at roadside about half-way between Alltan Fearna and Allt a'Chùirn, and between Allt an Achaidh and Allt na Crìche.

23, 51.

A. PTARMICA L.

N, G.

Coille na Glas-leitire; very rare in wet birch wood near Rhu Noa, and at c. 800 feet in rocky places south of Alltain Ruadh.

9, 15.

CIRSIIUM PALUSTRE (L.) Scop. N.

Occasional in the north-east up to 1200 feet in stream-sides and damp slopes below crags.

5, 9, 10, 14-16.

**C. HETEROPHYLLUM* (L.) Hill N, G.

Rare: in certain Mollinietum at 400 feet, a grassy slope at 1100 feet, a rocky dry stream-bed at 1100 feet and near roadside in a wood.

HYPOCHAERIS RADICATA L. N, G.

Seen at c. 250 feet in dry stream-bed near Allt Coir' an Laoigh.

59.

LEONTODON AUTUMNALIS L. N, G.

At c. 300 feet in bouldery stream-sides near Allt Coir' an Laoigh, Alltan Fearna and Allt na h-Airidhe.

16, 50, 59.

HIERACIUM spp.

4, 10, 33, 43, 44, 59.

The following were collected (all det. J. E. Raven):

H. VULGATUM (Fr.) Almq. N, G.

Stony stream-side at 200 feet, Allt a'Chùirn.

43, 44.

H. ? RUBICUNDUM F. J. Hanb. N.

At c. 100 feet on grassy stream-bank in pine-birch wood.

10.

H. JOVIMONTIS (Zahn) Roffrey N, G.

At 100-200 feet on grassy stream-bank in pine-birch wood and by stream-side, Allt a'Chùirn.

10, 44.

H. ARGENTEUM Fr. N.

Among rocks by stream-side at c. 1450 feet, Allt Toll a'Ghiubhais.

33.

H. ? LASIOPHYLLUM Koch. N.

Dry stream-bed at 250 feet, Allt Coir'an Laoigh.

59.

H. ANGLICUM Fr.

N.

Among rocks by stream-side at *c.* 1450 feet, Allt Toll a'Ghiubhais.
33.

CREPIS PALUDOSA (L.) Moench

N, G.

Seen up to 300 feet in wet rocky places; near Loch Clair. Allt an Achaidh, Allt na h-Airidhe and near Alltain Ruadh.

10, 16, 23, 56.

TARAXACUM SPECTABILE agg.

N, G.

Frequent in rocky places, stream-sides and ledges especially about Coille na Glas-leitire; up to 2000 feet on Ruadh-stac Beag. (Det. or Conf. E. C. Wallace.)

9, 10, 14-16, 23, 27, 32, 33, 35, 44, 59.

TRIGLOCHIN PALUSTRIS L.

N, G.

Rare; Coille na Glas-leitire at *c.* 50 feet in damp grassy strand near Rhu Noa and near Alltain Ruadh in the wood.

10, 15.

POTAMOGETON POLYGONIFOLIUS Pourr.

N, G.

Common in boggy pools and ditches; in the north-west corner at 1500 feet, Drochaid Allt Toll a'Ghiubhais, Caochan Bàn, Meall Fearnna, southern part of Meallan na Circe-fraoich, roadside at Allt a'Chùirn, and roadside from Free Church Manse to head of Loch Maree. (Det. R. Mackechnie.)

1, 2, 17, 23, 26, 36, 37, 44, 49.

NARTHECIUM OSSIFRAGUM (L.) Huds.

N, G.

Widespread and common in wet acid places up to *c.* 1700 feet; infrequent in the north-east from Allt na h-Airidhe to Allt Craobh an Tàimh.

1, 2, 4, 8, 10, 15, 16, 21-23, 26, 27, 29, 31, 33, 35-38, 41, 43, 44, 46, 48-50, 59.

ENDYMION NONSCRIPTUS (L.) Garcke.

N, G.

Only in the north-east; uncommon; below 500 feet at stream-sides, Allt an Achaidh, Allt na Criche, Allt na h-Airidhe, Allt Craobh an Tàimh and the next two streams to the north; at *c.* 1200 feet on bouldery ground near north-facing crags below Meall na h-Airidh-ardain.

2, 5, 9, 16, 23.

JUNCUS SQUARROSUS L.

N, G.

Common in moist acid places mostly below 1500 feet but occasionally to 2200 feet; rare in area to north-east of Meall na h-Airidh-ardain crags.

1, 8, 10, 16, 18, 21-23, 26, 27, 29, 31, 33, 38, 41, 44, 46, 49, 53, 56.

J. TRIFIDUS L.

N, G.

Locally abundant above 2000 feet to summits (but at 1400 feet by side of Allt Toll a'Ghiubhais) around Coire Domhain and the east side of Ruadh-stac Beag; in small scree.

32, 33, 38, 40, 41, 47, 48.

J. BUFONIUS L.

N, G.

Seen in wet area of felled pine wood, about 100 yards south-west of Rhu Noa.

16.

J. EFFUSUS L.

N, G.

Below c. 1500 feet, not infrequent in stream-banks.

5, 9, 10, 15, 16, 22, 23, 27, 33, 36, 37, 43, 44, 50, 53, 59.

J. CONGLOMERATUS L.

N, G.

Below c. 1200 feet; much the same distribution as *J. effusus* but occurs also in acid moorlands.

2, 4, 5, 9, 10, 15, 16, 22, 23, 35-37, 42-44, 48, 49, 53.

J. ACUTIFLORUS Hoffm.

N, G.

Seen at 50 feet by stream-side near Alltain Ruadh in birch wood.

10.

J. ARTICULATUS L.

N, G.

In birch wood at c. 100 feet by stream-banks near Alltain Ruadh, in wet birch wood near Rhu Noa, and near roadside between Loch Maree and the Free Church Manse.

10, 15, 17.

J. BULBOSUS L.

N, G.

Mostly not above 1000 feet; common in wet places especially in streams around Carraig Alltan Mhic Eòghainn; stream-sides, moors, bogs and wet woodland. (Det. R. Mackechnie.)

4, 8-10, 15-17, 22, 29, 33, 36, 43, 44, 49, 59.

LUZULA PILOSA (L.) Willd.

N.

Seen at *c.* 100 feet by stream-bank at Allt na h-Airidhe in Coille na Glas-leitire.

16.

L. SYLVATICA (Huds.) Gaud.

N, G.

Locally abundant; ascends to 3000 feet; rocky stream-sides, peaty places in screes, and ledges on crags.

9, 13, 15, 16, 18, 23, 27, 32, 33, 35, 38, 41, 44, 47, 59.

L. SPICATA (L.) DC.

N, G.

Seen at ridge north of Coire Domhain on crags at 2500 feet and at Sgùrr na Conghair on scree at 1200 feet. (Conf. R. Mackechnie.)

41, 48.

L. CAMPESTRIS (L.) DC.

Seen at 1300 feet on the banks of Allt na Doire-daraich and at *c.* 600 feet in the gorge of Allt a'Chùirn.

27, 43.

L. MULTIFLORA (Retz.) Lej.

N, G.

Locally common by stream-sides below 500 feet but occasionally higher; up to 2200 feet on Ruadh-stac Beag and Meall a'Ghiubhais in peaty and rocky places.

5, 8-10, 15, 16, 19, 23, 27, 32, 33, 38, 44, 50, 53, 59.

***LISTERA CORDATA (L.) R. Br.**

N, G.

Locally occasional in peaty places, often in the shade of *Calluna*; sometimes up to *c.* 1500 feet.

***GYMNADENIA CONOPSEA (L.) R. Br.**

N, G.

Seen only at *c.* 400 feet on a hillside.

***PLATANThERA BIFOLIA (L.) L. C. Rich.**

N.

Local up to *c.* 500 feet on heathy moorland.

***ORCHIS MASCULA L.**

N, G.

Seen at *c.* 1250 feet on certain crags.

O. ERICETORUM E. F. Linton

N, G.

Common and widespread up to 2000 feet; stream-sides, bogs, moors, screes and other rocky places; rare between Allt na h-Airidhe and Allt Craobh an Tàimh.

1, 2, 4, 8, 9, 13-15, 19, 21, 23, 26, 27, 29, 32, 33, 35-38, 41-44, 48-50, 56, 59.

ERIOPHORUM ANGUSTIFOLIUM Honck.

N, G.

Occasional in bogs and wet areas by streams up to c. 1000 feet from the south to Allt a'Chùirn, and in Coille na Glas-leitire; at c. 1700 feet in Toll Bàn and Coire Ruadh-staca.

15, 16, 31, 33, 41-43, 49, 50, 56, 59.

E. VAGINATUM L.

N, G.

Distribution similar to that of *E. angustifolium* but appears to ascend more readily to c. 1700 feet.

8, 13, 16, 27, 31, 33, 41-43, 46, 59.

TRICHOPHORUM CAESPITOSUM (L.) Hartman ssp. **GERMANICUM** (Palla) Hegi

N, G.

Abundant and widespread up to 3000 feet; damp heathy moorland, bogs, stream-sides and rocky hillsides; not so common about Coille na Glas-leitire.

1, 2, 4, 8, 10, 13-16, 19-22, 27, 29, 31-33, 36-38, 41-44, 46, 48-50, 53, 59.

SCHOENUS NIGRICANS L.

N.

Seen in moorland at c. 700 feet near Alltan na Caise. (Det. R. Mackechnie.)

49.

ELEOCHARIS MULTICAULIS (Sm.) Sm.

N, G.

Seen in *Eriophorum*-bog close to Torridon road, at c. 400 feet near Allt Coir' an Laoigh. (Det. R. Mackechnie.)

59.

CAREX HOSTIANA DC.

N, G.

Seen on lower hillside at c. 400 feet, Torridon roadside near Loch Clair and at c. 850 feet on rock-ledges above Alltain Ruadh. (Det. R. Mackechnie.)

9, 56.

C. BINERVIS Sm.

N, G.

Common; ascends to 2000 feet in stream-sides and damp heathy and rocky places.

4, 9, 10, 13, 15, 16, 23, 27, 29, 32, 33, 35-37, 41, 42, 44, 50, 59.

***C. DEMISSA** Hornem.

N, G.

Rare; seen up to c. 1000 feet on a rocky slope and in a wet birch wood. (Det. R. Mackechnie.)

C. REMOTA L.

N.

Seen at *c.* 100 feet by small stream in wood, close to the most northerly part of the Reserve. (Conf. R. Mackechnie.)

2.

C. PALLESCENS L.

N, G.

Not uncommon up to 1500 feet by streams and damp rocky ground in Coille na Glas-leitire from Rhu Noa to Alltain Ruadh; also in the birch wood in the north and at *c.* 600 feet in a narrow stream in Alltan Fearna. (Conf. R. Mackechnie.)

5, 9, 10, 14-16, 49.

C. PANICEA L.

N, G.

Common up to 1700 feet northwards from Coille na Glas-leitire; at 1700 feet on Ruadh-stac Beag and up to 700 feet along the Torridon road, stream-banks, moorlands, bogs, and wet parts of woods. (Det. R. Mackechnie.)

2, 4, 5, 8-10, 14-16, 32, 33, 49, 56, 59.

C. FLACCA Schreb.

N, G.

Damp places; about Alltain Ruadh to 1200 feet, stream-sides and crag-ledges; at 500 feet Allt na h-Airidhe, at 1000 feet Allt a'Chùirn, and at 1800 feet Ruadh-stac Beag. (Det. R. Mackechnie.)

C. PILULIFERA L.

N, G.

Locally common in rocky heathy places and screes from 1000 to 2000 feet; Coir'an Laoigh, Toll Bàn (also in bog), Sgùrr na Conghair, Drochaid Allt Toll a'Ghiubhais, crags below Meall na h-Airidh-ardain, and at northern end of Druim Grudie; also at 200 feet in Coille na Glas-leitire. (Det. R. Mackechnie.)

4, 9, 10, 14, 19, 27, 32, 33, 38, 46, 48, 53.

C. NIGRA (L.) Reichard

N, G.

Scattered; by stream-banks, wet parts of wood and wet moorland up to 1000 feet (but by Allt Toll a'Ghiubhais at 1500 feet).

4, 10, 15, 22, 33, 42, 56, 59.

C. BIGELOWII Torr.

N, G.

From 1000 feet to the highest summits; occasional to frequent on the high screes, rare in the wet rocky areas at the lower levels.

8, 13, 14, 19, 25, 32, 38, 40, 41, 47, 48, 53.

C. ECHINATA Murr.

N, G.

Stream-sides up to 500 feet in the south and south-east; up to 1200 feet in the north-east where it is more common; also in a wet bog at 1500 feet in Toll Bàn. (Conf. R. Mackechnie.)

1, 4, 5, 9, 10, 15, 16, 22, 33, 36, 37, 44, 50, 56, 59.

C. OVALIS Good.

N, G.

Seen at c. 400 feet by Torridon road near Allt Coir' an Laoigh. (Det. R. Mackechnie.)

59.

C. PAUCIFLORA Lightf.

N, G.

Occasional in *Eriophorum*-bog at c. 400 feet near Allt Coir' an Laoigh and in wet part of felled pine wood near Rhu Noa.

16, 59.

C. PULICARIS L.

N, G.

Common up to 1200 feet on stream-banks and other damp places about Coille na Glas-leitire, also in damp moorland near Loch Clair and Loch Bharranch. (Conf. R. Mackechnie.)

4, 9, 10, 14-16, 56, 59.

MOLINEA CAERULEA (L.) Moench

N, G.

Plentiful and widespread; reaches 2200 feet but much less common above 1500 feet except in Toll Bàn and Coire Ruadh-staca.

4, 5, 9-10, 14-16, 19, 27, 31-33, 38, 42-44, 46, 48-50, 53, 59.

GLYCERIA FLUITANS (L.) R. Br.

N, G.

Seen by ditch near road at Free Church Manse.

17.

FESTUCA RUBRA L.

N, G.

Ledges and stream-banks up to 1200 feet about Coille na Glas-leitire; at c. 400 feet by Allt na Coir' an Laoigh. (Det. R. Mackechnie.)

4, 9, 10, 15, 16, 53.

F. OVINA L.

N, G.

Lowland, stream-banks and moorlands in the east and in Coille na Glas-leitire. (Conf. R. Mackechnie.)

15, 44, 50.

F. VIVIPARA (L.) Sm.

N, G.

Common up to 1500 feet in damp places and in screes up to 2500 feet in Toll Bànn and Coir Ruadh-staca.

8-10, 15, 16, 21, 27, 32, 33, 36-38, 41, 46, 48, 57, 59.

POA ANNUA L.

N.

In pine wood near Allt na h-Airidhe at c. 250 feet; rare.

16.

HOLCUS LANATUS L.

N, G.

Uncommon; up to 1200 feet about Coille na Glas-leitire; waste ground near road, wet parts of birch and pine woods, rocky places; also in moorland by Torridon road near Loch Clair.

5, 9, 15, 16, 56.

H. MOLLIS L.

N, G.

Local; in woods near Rhu Noa; at c. 1200 feet on bouldery slope beneath north-facing crags below Meall na h-Airidh-ardain.

9, 15, 16.

DESCHAMPSIA CAESPITOSA (L.) Beauv.

N, G.

Common in damp places up to 1500 feet, Allt Coir' an Laoigh; at c. 600 feet in Allt a'Chùirn; at c. 1400 feet in Allt na Doire-daraich; at c. 1500 feet and 2200 feet in Toll Bànn and up to 1200 feet at Coille na Glas-leitire from Alltan Mhic Eògann to Alltain Ruadh.

9, 10, 15, 16, 27, 32, 33, 38, 43, 46, 53, 59.

D. FLEXUOSA (L.) Trin.

N, G.

Common and widespread up to the highest summits on exposed hillsides and in lowland woods.

4, 8-10, 15, 16, 19, 22, 27, 32, 33, 38, 40, 41, 44, 46-48, 53, 57, 59.

ANTHOXANTHUM ODORATUM L.

N, G.

Lowland; frequent up to c. 1500 feet in roadsides, moorland and damp ledges; at 2000 feet on Ruadh-stac Beag.

9, 10, 15, 16, 27, 32, 33, 36, 37, 44, 53, 56, 57, 59.

NARDUS STRICTA L.

N, G.

From c. 400 feet to the highest summits (where it is often frequent); uncommon towards the north and only occasional at the lower altitudes in bogs, moors and stream-sides.

4, 9, 10, 27, 32, 33, 38, 40, 47, 48, 50, 59.

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